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LONDON, AUGUST, 1910.

BUNKER EXPLOSIONS.

THE evidence given at the enquiry ordered by the Board of Trade relating to the explosion which occurred on the Cairn liner *Cairnrona* in April last affords food for serious reflection. It will be remembered that the casualty took place when the steamer was about ten miles off Beachy Head, resulting in the death of one man, and injury to a number of passengers, while damage was done to the ship itself. A considerable amount of time was taken up in taking evidence from experts as to the character of the coal in the bunkers where the explosion occurred, and in solving what appeared at first sight to be somewhat of a mystery. In the end the court had no difficulty in arriving at a definite conclusion of a simple character. In the judgment the court state that red-hot ashes and cinders were found in the starboard side bunker before the bunkering commenced in London, probably due to having fallen through the open bunker door when the fires were being drawn. It was not clearly established that this fact was communicated to the master, but it was to one of the engineers, but which one was not clear; anyhow the red-hot ashes and cinders were neither removed nor effectively quenched. The condition of the bunker coal was known to the chief engineer when the ship left Gravesend, and the vessel ought not to have been taken to sea with the bunker coal in such a condition. After leaving Gravesend the heating in the bunker increased, but proper measures were not taken by the chief engineer to ensure safety, nor by the master in consequence of his not having received information from the chief engineer. On April 7th three explosions occurred, the cause being the hot ashes left in the bunker, which became covered up in the operation of coaling, and in time set up slow combustion and generated gas. As the coal was worked out from the bunker more air was admitted which, combining with the gas, became an explosive mixture. When the coal got low enough to admit air to the seat of the fire a flame or spark broke out, which ignited the gas. The other explosions were caused by the gas being in different recesses of the bunker, which ignited in a similar manner as above stated. The death of the assistant steward, who was the man killed, was in the opinion of the court caused by the flame and shock following the explosion, which blew off the bunker hatches on the shelter deck, and injuring five others. The hull of the ship was not damaged in any way, but some damage was done to the hatches and fittings. The loss of life was not caused by the wrongful act of the master or second engineer, but by the default of the chief engineer, and the court severely censured him for not taking further steps for ensuring the safety of the vessel and those on board. It will thus be seen that no difficulty was encountered in arriving at this result. Now the serious feature of the case to our mind is the fact that here is a steamer of some 5,000 tons burden, carrying nearly 900 emigrants, which is allowed to start from Gravesend with a chief engineer having the knowledge that a serious condition of things existed in the bunkers and his sense of responsibility is so small that he does not acquaint the master of the situation, but lightheartedly permits the ship and its human cargo to put to sea. It is difficult to realize how an individual can take such a risk single-handed, and it is indeed a matter of satisfaction that the ultimate effect of such folly was not more extensive than it was, having regard to the possibilities. In conclusion it is most satisfactory that the matter has been cleared up in such a conclusive manner, and one is led to express a hope that it may be a warning to others not to take unnecessary risks.

COMPULSORY PROVISION FOR WIRELESS TELEGRAPHY.

OUR cousins on the other side of the Atlantic have in their wisdom passed an Act in Congress which provides that from and after the 1st July, 1911, every ocean-going ship of the United States or any foreign country, carrying passengers and crew numbering fifty or more persons, shall not leave any U.S.A. port unless equipped with an efficient wireless installation capable of transmitting and receiving messages through over 100 miles distance, with a properly qualified person in charge to work it. This does not apply to steamers plying only between ports less than 200 miles apart. A penalty of 5,000 dollars is provided on conviction for violation of the regulation, and a lien on the ship is created as security for payment of such fine. We have nothing to say with reference to the wisdom or otherwise of the passing of this Act by the United States Congress, as the condition of the mercantile marine of that country has special characteristics of its own, but we do express our surprise that Sir Edward Sassoon should have thought fit to introduce a Bill into the British House of Commons on the same subject and in practically identical terms to the U.S.A. Act.

The Bill was strenuously opposed by Mr. Gibson Bowles on what seems to us to be incontrovertible grounds. In the first place all our large passenger steamers have already largely provided themselves with wireless installations and the bulk of the vessels not so provided do not require it; and in the second place a large proportion of British steamers trade in parts of the world where wireless stations do not exist at all, and therefore the promoter of the Bill is in effect asking for powers to enable the Board of Trade

to place an altogether unnecessary burden on shipowners. The burden, too, if the bill were passed, would fall upon the owners of smaller ships, who are far less able from a financial standpoint to install apparatus which, owing to the trading area of their ships, cannot be usefully employed during the main part of the time of employment. We believe that some of our largest shipping companies have found that in actual practice the wireless installations have had small utility owing to the want of enterprise of our colonial governments in providing stations. A point that should not be lost sight of is that year by year new ships are built and are largely equipped with wireless installations, so that automatically, so to speak, a material extension is being made in the proper direction along lines which are dictated by sound commercial policy on the one hand, and the safety and convenience of the public on the other, so that the necessary expense can be usefully taken advantage of. The main contention of the promoters of the bill appears to be that because the U.S.A. Congress has passed the Act we should follow the example, but it seems to us that the converse is the more consistent, having regard to the different conditions which obtain in the two countries. The bill was read the first time, and we most profoundly hope that it will stop there, so that the unnecessary burden involved in such a provision may not be placed upon a body of commercial people who already have enough to contend with owing to trade depression and strong competition. We think the thanks of shipowners are due to Mr. Gibson Bowles for his vigorous opposition to this altogether unnecessary proposal.

HONG-KONG HARBOUR.

We have been favoured with a copy of a very interesting report issued by the Harbour-master of Hong-Kong, dated March 1st, containing a large amount of information on the subject of the shipping of the port. The total number of vessels entering and clearing during the year 1909 amounted to 527,230, with an aggregate tonnage of 34,830,845, being a decrease of 4,832 vessels compared with 1908, but an increase in tonnage of 215,604 tons. This shows the prevailing tendency to larger vessels. Foreign ocean vessels have increased by 186 ships of 460,072 tons, this being due mostly to Japanese vessels, which increased by 118 in number and by 459,292 tons. Norwegian increased by fifty-eight vessels and 64,400 tons, Swedish by forty-seven and 70,265 tons, Portuguese and Dutch also show increase. The decreases which took place were of the following nationalities:—French, forty-five vessels, equal to 58,133 tons; German, nineteen vessels or 16,848 tons, with smaller decreases of vessels under the flags of Russia, Austria and Italy. By a curious anomaly the United States sent an increase of seven vessels, but the tonnage was decreased by 42,211 tons, so also with Chinese vessels, an increase of two brought about a decrease of 3503 tons. The total number of vessels during the year 1909 which entered the colonial waters of Hong Kong amounted to 704, exclusive of river steamers, and of these 336 were British and 368 foreign. The numbers for 1908 were 745, 365 and 380 respectively. The aggregate tonnage for 1909 vessels entering was 1,682,845. The figures for twenty years ago show that in 1889 the number of British vessels which were entered amounted to 2591, equal to 3,242,953 tons, while in 1909, the number rose to 9856 vessels, equal to 11,437,681 tons. The number of entries of vessels other than British in 1889 amounted to 1144, equal to 1,206,983 tons, and in 1909 the number amounted to 5688, equal to 8,593,590 tons. The figures representing the number of vessels refer to the number using the port; these vessels may enter several times during the year, each entry being counted in the aggregate return.

MODERN SHIPYARD MACHINERY AND EQUIPMENT.

V.

(*Continued from page 413, Vol. XXXII.*)

Lift Equipment at Building Berths.

Electric winches for shipyard work are a speciality of the Sunderland Forge and Engineering Co., Ltd., whose works, being situated in a busy shipbuilding centre, are largely devoted to meeting the requirements of shipbuilders and engineers. The illustrations, Figs. 1, 2 and 3, show this company's latest standard winches for shipyard work. These represent both worm and spur geared winches, and are made in various sizes and lift weights up to five tons at suitable speeds. They are of simple but substantial construction, and withstand the roughest treatment. Having the electrical portion of their equipment completely cased in, they may be placed in the most exposed positions without any risk of insulation troubles. The motors are of the "Pallion" multipolar type, and specially designed for this class of work, the controller and resistance being arranged inside the motor casing. Adequate protection is thus ensured for all the current-carrying parts, and the design is such that all parts of the motor and controller are easily accessible. The motors are series wound and have ample power to lift loads at the required speeds, the lighter loads, of course, being lifted at faster rates. They have shafts specially strong, with large bearing surfaces to take excessive weights and can withstand sudden and heavy overloads without sparking at the brushes. Winches are also made fitted with standard alternating current motors. The controllers, of the tramway reversing type, are arranged inside the motor casing. Metallic resistances, specially designed to go inside the motor casing, are arranged so that the working of the controller on the various resistance stops, for considerable periods, does not overheat the resistance.

These winches are fitted with a powerful footbrake, which acts on the motor shaft, and is so constructed that the brake sheave is gripped between two brake blocks and prevents any strain being thrown on the motor bearings when the brake is applied. The first reduction from the motor is by means of a worm gearing, entirely enclosed in a cast-iron case, and revolving in an oil bath. The worm is of steel cut from the solid, case-hardened, and engages with a phosphor-bronze worm wheel. The end thrust being taken by a ball thrust block, friction is reduced to a minimum. The second reduction is by cast-iron spur gearing, and all gear has guards for preventing injury to workmen.

Various types of electric winches well adapted for shipyard work and designed to lift from 1½ to 5 tons, at from 50 ft. to 60 ft. per minute are made by Messrs. Mactaggart, Scott and Co., of Loanhead, Edinburgh, and Figs. 4 and 5 illustrate two of these which have been installed in a number of important shipyards throughout the kingdom. Fig. 4 represents a 3-ton spur-geared winch, while Fig. 5 is a winch of similar capacity and practically of similar construction, save that it is fitted with worm instead of spur-gear reduction. When exerting a pull of 3 tons on the rope the speed is 60 ft. per minute. The sole-plate and standards are strong castings, and the main and intermediate shafts are of mild steel, turned. The gearing consists of a machine-cut steel pinion on the motor spindle, which gears with a machine-cut cast-iron spur-wheel on intermediate shaft. A machine-moulded cast-iron pinion on the intermediate shaft gears with a machine-moulded cast-iron spur wheel on the main shaft. All gearing is enclosed in gear guards. The winding drum, which is 13 in. diameter by 27 in. face, is mounted free on the main shaft and engages to same by means of a claw clutch controlled by a hand lever. Warping ends are 13 in. diameter, specially designed for wire rope, and are securely keyed on ends of main shaft. A wood-lined band brake is fitted on second motion shaft and a band brake is also fitted on winding drum, and both are controlled by foot lever. The electrical equipment of the winches consists of 21 B.H.P. motor, running at 500 r.p.m. for 480-volt direct-current circuit, suitable controller, resistances and double-pole switch, all compact on bedplate and attachment faces. Resistances, etc., are neatly enclosed in mild steel waterproof casings.

Messrs. Royce, Ltd., Manchester, whose electrically-driven overhead cranes are so well known in the engine boiler and other shops of engineering and shipbuilding establishments, are also specialists in electric winches, capstans, etc., employed for hauling and hoisting at shipbuilding berths. Fig. 6 shows one of this company's electric winches for shipyard work which is of compact design and is fitted with the Royce friction driving device. In this case it is applied to the first motion spur wheel. The rim of this wheel is coupled to the hub by frictional grip alone, the amount of which can be readily adjusted so that should the load upon the teeth exceed the normal, the rim will slip relatively to its boss and prevent damage to the motor or gearing. This mechanical "safety-valve" is, it appears to us, superior to fuses or a circuit breaker. It requires no re-setting, thus obviating waste of time. The hoisting barrel can be disengaged for lowering with free barrel. The Royce Co. make a large number of electrically-driven transporters, and Fig. 7 shows one of these provided with swivelling bogies for negotiating curves, constructed to operate on a track that is straight

the hoisting of the lighter materials, such as could not conveniently be handled by heavy overhead cranes, and were found of immense service in the raising or lowering from deck to deck of structural items, which under ordinary circumstances the workmen would have had to carry up or down the hatch ladders in the centre of ships. Although the ordinary—and now old-fashioned—broad sloping wood gangways alongside the berths were still necessary for long items and for general exit or entrance of workmen in large bodies, the electric lifts effected great saving in time, and eliminated incalculable risk in the conduct of work, and were the means of rapidly conveying individual or small bodies of workmen to deck levels at which their work lay.

This refinement of modern facility for moving workmen and material is at present finely exemplified in the electric lifts which are fitted in connection with the berth structures under which the huge steamers *Olympic* and *Titanic* are being built for the White Star Line in the works of Messrs. Harland & Wolff, Belfast. The lifts in question, which have been installed by Messrs. R. Waygood & Co., Ltd., of Falmouth

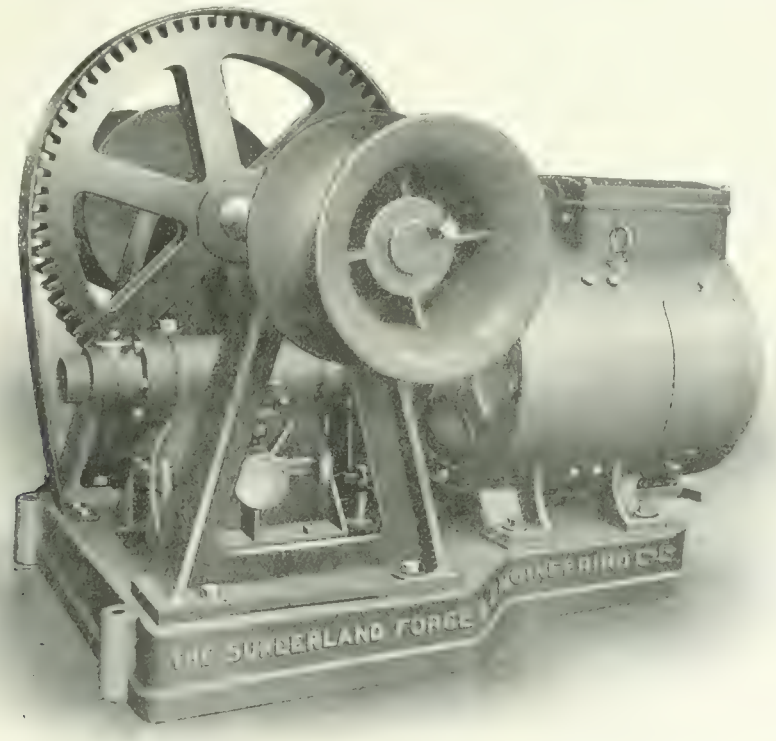


Fig. 1.—Electric Winch, Worm and Spur Geared, for Shipyard Work.
The Sunderland Forge and Engineering Co., Ltd.

or approximately so. A special feature of this machine is the provision of two distinct hoisting barrels and ropes which can be spaced at any desired distance apart. This construction is especially adapted to the transport of long ship plates, since it compels them to remain in a fore and aft position during transit, and thus no guy rope is needed to prevent them from revolving. All their transporters are designed to run upon the bottom flanges of the track joists, thus making the suspension of the latter a simple problem involving no cranked hangers, etc., and simplifying the construction of any switches that may be required.

In connection with such mammoth liners as the *Lusitania* and the *Mauretania* in British yards, and possibly in connection with other great steamships built in Germany and France, where the duration of constructional work warranted the outlay, electric lifts have been employed for conveying workmen from ground level to the upper deck of the steamers, or to intermediate levels corresponding with the several decks. Such lifts were, of course, also intended to deal with

Road, London, are fitted in pairs alongside of, and about mid length of, the building berths, and Fig. 8 shows one pair as fitted at one of the building berths. Each pair is fitted in a self-contained, wrought-iron structure, which is strongly stayed at the top to the berth structure. Each lift is constructed for a load of 3 tons at a speed of 125 ft. per minute. The rise of the several lifts varies slightly, but the average is about 96 ft. The working power is obtained from the shipyard's continuous current supply at 440 volts.

The cages, which are 8 ft. 3 in. wide by 10 ft. 6 in. deep by 7 ft. high, are very strongly constructed with steel channel suspension bar, and steel angle framing filled in at the sides with sheet steel and with checkered plate flooring. Each cage is suspended by four best steel wire lifting ropes 2 in. circumference. The lifts are arranged so as to serve at three landings, the middle one being arranged to vary in accordance with the level at which the work is being done in the ship. Each opening is protected by a collapsible gate which is electrically interlocked so as to

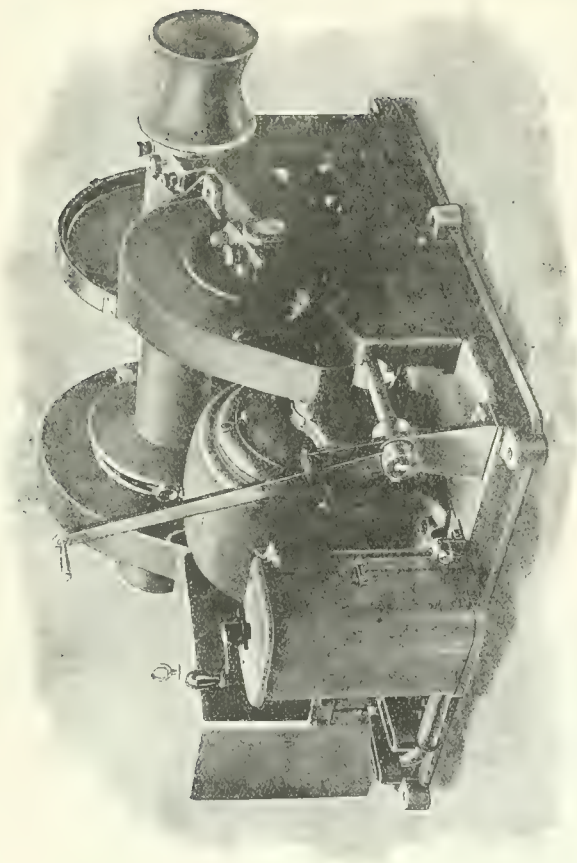


Fig. 4.—Electric Spur-geared Winch with independent Winding Barrel. Messrs Mactaggart, Scott & Co., Edinburgh

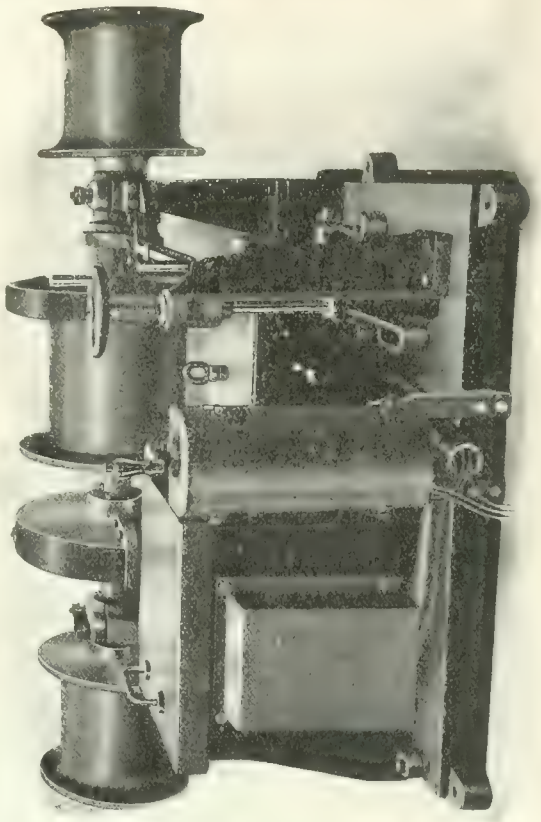


Fig. 5 Electric Worm-geared Winch with independent Winding Barrel Messrs Mactaggart, Scott & Co., Edinburgh

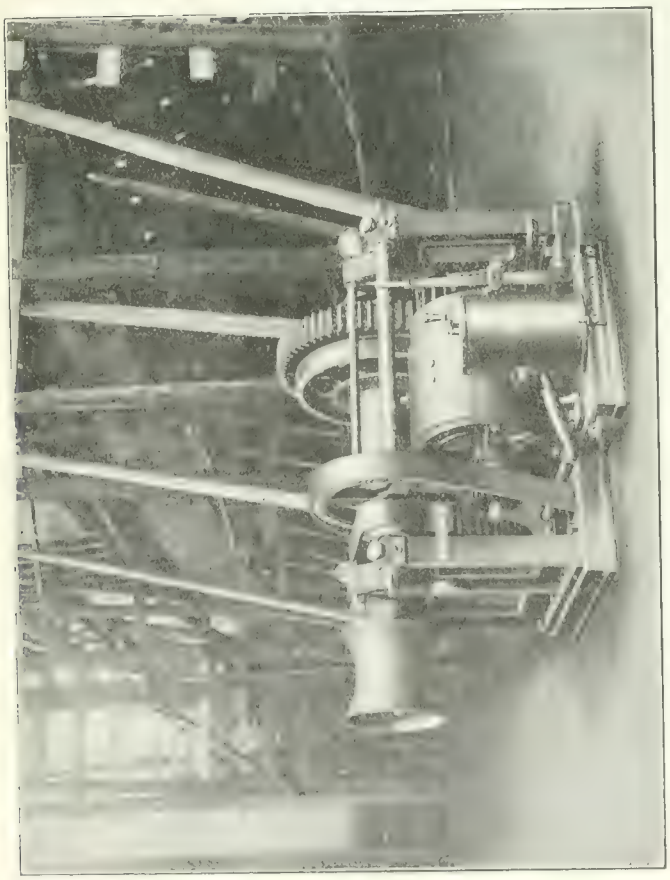


Fig. 2.—Electric Spur-geared Winch for Shipyards The Sunderland Forge and Engineering Co

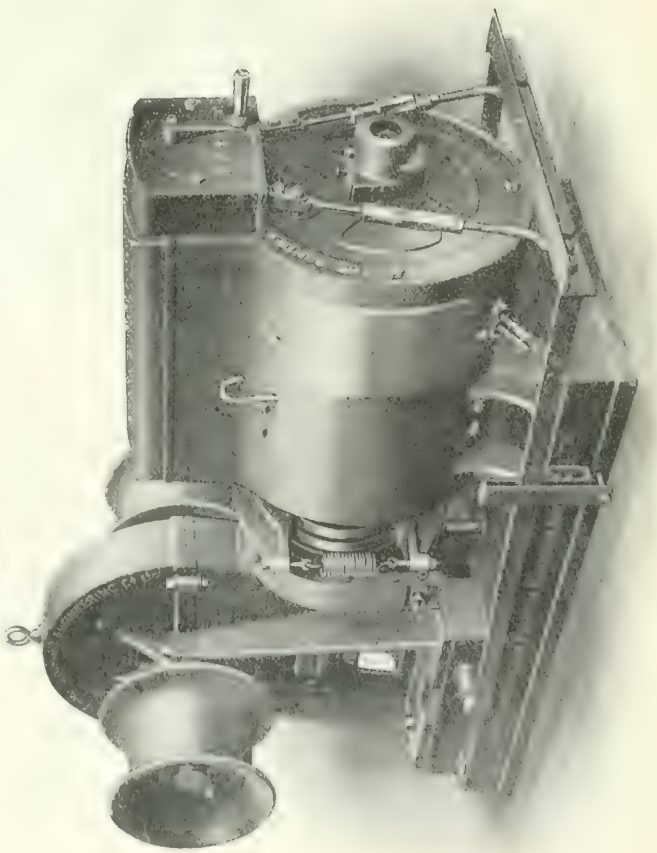


Fig. 3.—Electric Winch, single reduction, Worm-geared type The Sunderland Forge and Engineering Co., Ltd.

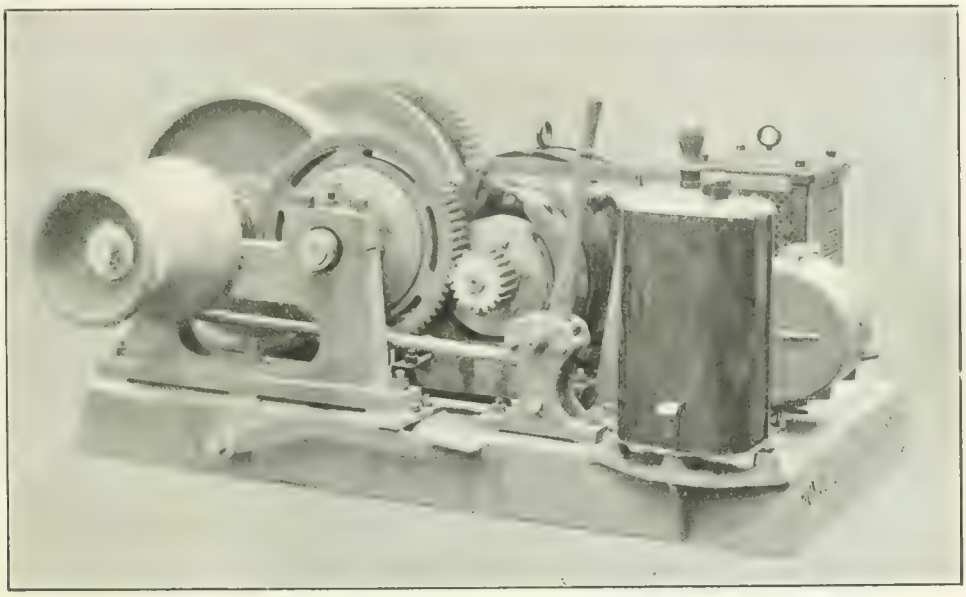


Fig. 6.—Electric Winch with "Royce" Friction Driving Device
Messrs. Royce, Ltd., Manchester.

prevent the lift being started away when the gate is open, or the gates opened unless the cage is opposite same. The cages are fitted with adjustable gun-metal guides at top and bottom to work against runners, and are roofed with strong wirework. The cages being open at back and front, each section is fitted with a heavy section collapsible gate which is electrically interlocked so that the cage cannot be moved unless both gates are closed. The cages are fitted with specially heavy safety gear consisting of four cams working on turned steel shafts, and arranged to grip on timber guides at the sides in case of failure of suspension ropes. The cage guides are of rolled steel joists filled in with teak, upon which

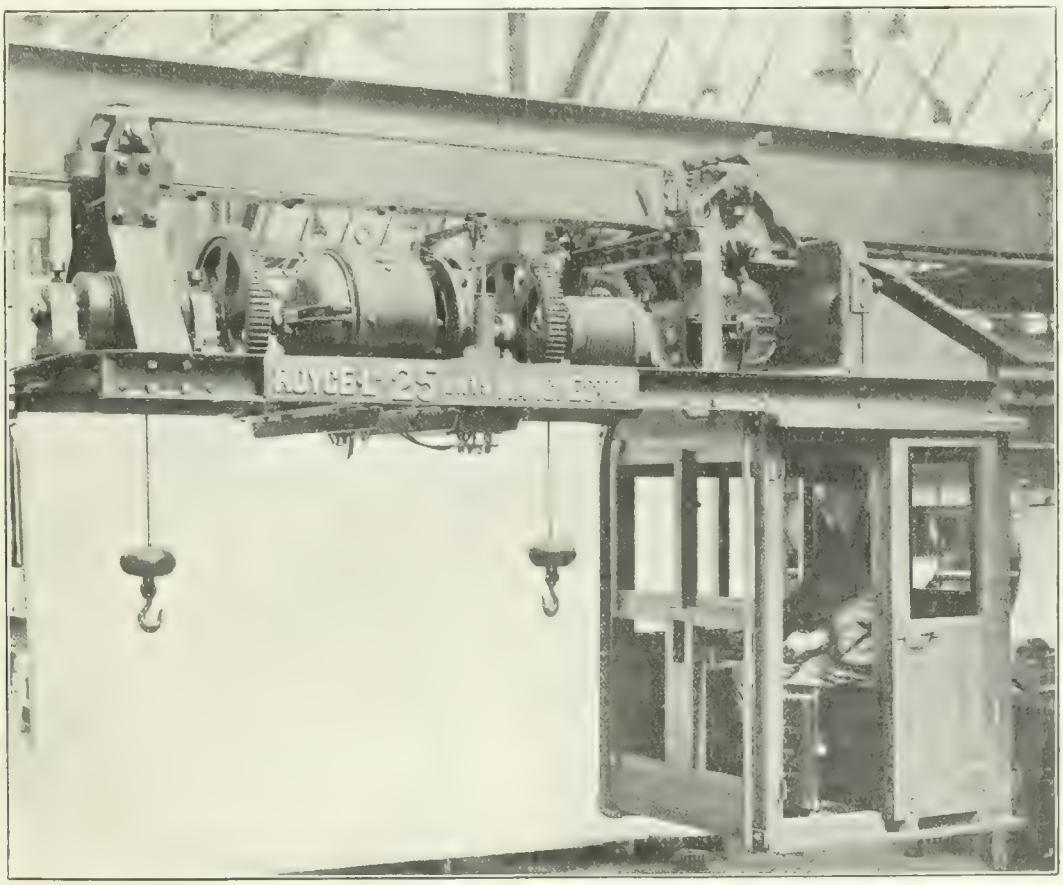


Fig. 7.—Electric Transporter Messrs. Royce, Ltd., Manchester.

the safety gear would act in case of emergency. Each cage is counterbalanced by cast-iron weight equal to about half the load in addition to the actual weight of cage. The counterbalance weight guides are fitted with gun-metal guides working against round turned steel runners. The motors are rated at 30 H.P., running at about 650 revs.; they are shunt wound and totally enclosed.

The motors are coupled directly to machine-cut worm and wheel winding gear, the worms being of steel specially case hardened, and the worm wheels having cast-iron centres and rims, and teeth of phosphor bronze. The gear is enclosed in cast-iron case which forms an oil bath. The thrust of worm shaft is taken by double ball thrust bearings. The worm wheel shaft carries a V-grooved winding sheave 3 ft. 6 in. diameter which is turned to suit the four steel wire lifting ropes. The controller is of the makers' standard design specially arranged for heavy duty. It is operated by a car switch fitted in the cage with self-centring detachable handle. Special over-run limit switches are provided at top and bottom to prevent overtravel, and as an additional precaution a main limit switch is provided which will be operated by the movement of cage, to cut off the main current and prevent overrunning in case of failure in the ordinary controller.

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

Disasters.

AN unusual collision was that by which the two steamships, *La Rochelle* of Bayonne and the *Yews* of Newry were both lost off the Skerries on the evening of the 19th June. The French vessel was much the larger of the two, being of between 1300 and 1400 tons gross register, whilst the colliding steamer was of but 333 tons gross. The contact took place in dense fog, and the Frenchman, which was taking a cargo of ore from Bilbao to Workington, went down almost immediately, some ten members of her crew being lost. The *Yews* fortunately remained afloat. But she, too, had a heavy cargo—pig iron—and it was at once seen that her plight was a desperate one. A passing vessel picked up the survivors of the Frenchman and also took charge of the bulk of the crew of the *Yews*. But the navigating officers, the engineers and a fireman of the British ship stood by their vessel in a boat. They dare not stay on board as they momentarily expected the fore bulkhead to burst and the ship to disappear. In this their expectations were justified. But their pluck in standing by on such a hopeless quest in darkness and fog, in a channel where at any moment they might be run down by a passing steamer, seems worthy of record.

An inquest was held by the coroner for Anglesey on the body of the cook of the French steamer, and the jury not unnaturally returned a verdict of accidental death. After the verdict had been returned a remark seems to have been made by the coroner to the effect that he was puzzled by what he considered to be the difference in the law relating to collisions at sea and similar accidents between vehicles on land. At the first blush we might retort that there is a whole body of law founded on the International Regulations for the prevention of collisions at sea, whilst on land the rules are comparatively simple and, indeed, such as they are, they differ in Britain from those prevailing in most other civilized countries. But an examination of his statement shows that the coroner took the opportunity of touching not upon the question of the prevention of collisions, but on the possibility of putting the criminal law in motion where gross negligence appears to have been shown by those in charge of one of the colliding ships. So far as I have seen, there is no suggestion that any one was guilty of criminal negligence in the case before him. But as to the abstract point he raised, it may well be pointed out that the duties of those who drive land vehicles are comparatively simple, and moreover that derelictions of those duties are easily brought home to them. Carriages and motor cars are driven along well-defined roads. People have to keep to their own side of the street, to pass only when there is room, and in passing to do so on the right side. Further, they must not exceed the speed limit. But that is all. On the sea there are no defined lanes. The navigator may see a light bearing in any direction, make up his mind whether the vessel to which it belongs is one for which he must manœuvre, and then consider which article or articles of the regulations apply to his case. If he makes a mistake his ship may be cast in damages in the Admiralty Court. But it is excessively difficult to prove that he was deliberately at fault or that he was guilty of criminal negligence. If such default could be proved against him to the satisfaction of a court of law the navigator of a ship would be punished for his act just as surely as would be the driver of a land vehicle who committed a similar offence.

A Long Run

has just been made by the steamship *Waimate* on her voyage to Vancouver. This vessel, which is owned by the Union Company of New Zealand, has recently steamed the whole 15,000 miles from the Clyde to Vancouver round Cape Horn, without ever stopping her engines. Accomplishing the voyage in sixty-two days, she maintained an average speed of 11½ knots over the whole course. I take it that this is a world's record. It certainly beats the Clyde to New Zealand ports run for distance and it considerably eclipses what I imagine to be the previous best achievement, that of one of the old White Star vessels, chartered to the Occidental and Oriental Company, which made a non-stop run from Liverpool to San Francisco many years ago.

The Plymouth Mail Traffic.

The long and costly fight between the Great Western and the London and South-Western Railways has at last come to an end, by reason of the agreement which has been arrived at by the companies in respect of the whole of the competitive traffic over their systems. The mail traffic from this particular port seems to go to the Great Western, which indeed seems the faster route of the two to London. But as the earnings are pooled, even to the extent of allowing return tickets to be used over either line, it does not seem to matter very much which line gets the actual carriage. The outward and visible sign of the treaty, as far as my readers are chiefly concerned, is seen in the announcement that the fine twin-screw passenger tender and tug *Atalanta*, which the South-Western had built in the year 1907, and which they stationed at Plymouth for use in the mail and passenger traffic, has now been taken over by the Great Western.

Another passenger development is noticeable. A new service is to be run from Plymouth to a Normandy port. It is at present maintained by weekly sailings. I notice that the vessels working it are the *Ibex*—one of the older Great Western steamers of the Weymouth fleet—and the other the *Bretonne*. The name of the latter will be unfamiliar, but probably the ship is not, for it conceals the identity of the twin-screw *Chelmsford*, which, till the coming of the new turbine vessels on to the Harwich route, was regularly engaged in the Great Eastern Railway's services to Dutch ports.

Amalgamations of Ocean Steamship Companies

continue. The latest is seen in the offer by Sir John Ellerman for the purchase of the fleet of the Shaw-Savill and Albion Company, which maintains a high-class passenger service to New Zealand. The tonnage affected amounts to 51,360 tons gross register, which is contained in some eleven bottoms, whilst a twelfth ship, the *Pakeha*, is under construction. Seven of the ships concerned are of the twin-screw type, and all of them are, I think, fitted with refrigerating installations—the dead meat trade being the staple of the business. Twin-screw vessels will be a novelty in the Ellerman fleet, for even on such passenger services as the City Line to Indian ports Sir John Ellerman has not considered it needful to duplicate machinery. It is to be hoped that the working of the new ships will be so satisfactory as to convert him to the adoption of the principle throughout his big fleet.

As appears from the report of the International Mercantile Marine Company, a number of the Shaw-Savill & Albion ships are jointly owned with the White Star Company, and some of the latter organization's vessels are owned jointly with Shaw-Savill. This intimate relation between the White Star and Shaw-Savill will bring Sir John once again

into contact with the combine—a fact which is interesting, when it is remembered that he divided the Leyland Company's fleet and went off with one part of it at the time of the reorganisation and combination. From this fact and from the closer terms with which the Royal Mail in its enlarged form has got with Lord Pirrie and his interests, one cannot help surmising that a far more gigantic interlacing of shipping interests, even than those that have of late taken place, may be possible in the near future.

Compulsory Wireless Telegraphy.

On the 1st July, 1911, the law of the United States will compel all the passenger steamers on its register to carry an efficient installation of wireless telegraphy on voyages of over two hundred miles on the open sea. Into our own legislature Sir Edward Sassoon has introduced a similar bill to enforce the installations upon British passenger vessels, and the measure has passed its first reading in the House of Commons. That the provision of such appliances for safety is necessary and advantageous need not be discussed since the case of the *Republic* occurred. It will be remembered that that crowded White Star passenger liner was struck by an Italian vessel, which herself was too much injured to be able to assist. In a dense fog the signal for assistance was sent out with persistent reiteration, and by its means adequate aid was summoned from the fog and guided to the place where the sinking liner lay. In consequence of the invention of Mr. Marconi then the lives of all on board the *Republic* were spared, and it should assuredly be that all Atlantic liners should be fitted with the installation—for in the North Atlantic there are already so many ships fitted and so many land stations available that full use of the appliance can be made. But in other trades we find that land stations are not yet always available throughout the voyage, even when the course lies within a moderate distance of the shore, and it therefore perhaps seems a little previous to enjoin that all passenger vessels in all trades should carry a device which in some instances may not be available for use. But that defect will soon be remedied, and Sir Edward Sassoon has done well for the sailor and the travelling public by introducing his measure.

A Famous Old Ship

has gone to the scrap heap in the *Astoria* of the Anchor Line, which has been towed from the Clyde to a German port of demolition. In the Anchor service she did not make much of a show with the larger and faster vessels against which she was running in their New York service. But in her early days she was record breaker in the New Zealand trade with her sister the *Arawa*. These two vessels were built in the years 1883 and 1884 by Messrs. Denny for the Shaw-Savill and Albion Line, and quickly achieved a name for themselves. For a time the *Tainui* was on the Spanish register, being employed as the *Covodonga* by the Compania Transatlantica of Barcelona at the time when the Madrid Government was pouring Spanish troops into the island of Cuba. The names *Arawa* and *Tainui* are, of course, now represented in the Shaw-Savill fleet by two twin-screw vessels of much greater size than the original bearers of the name, as are those of the other vessels of the older fleet which have been cast.

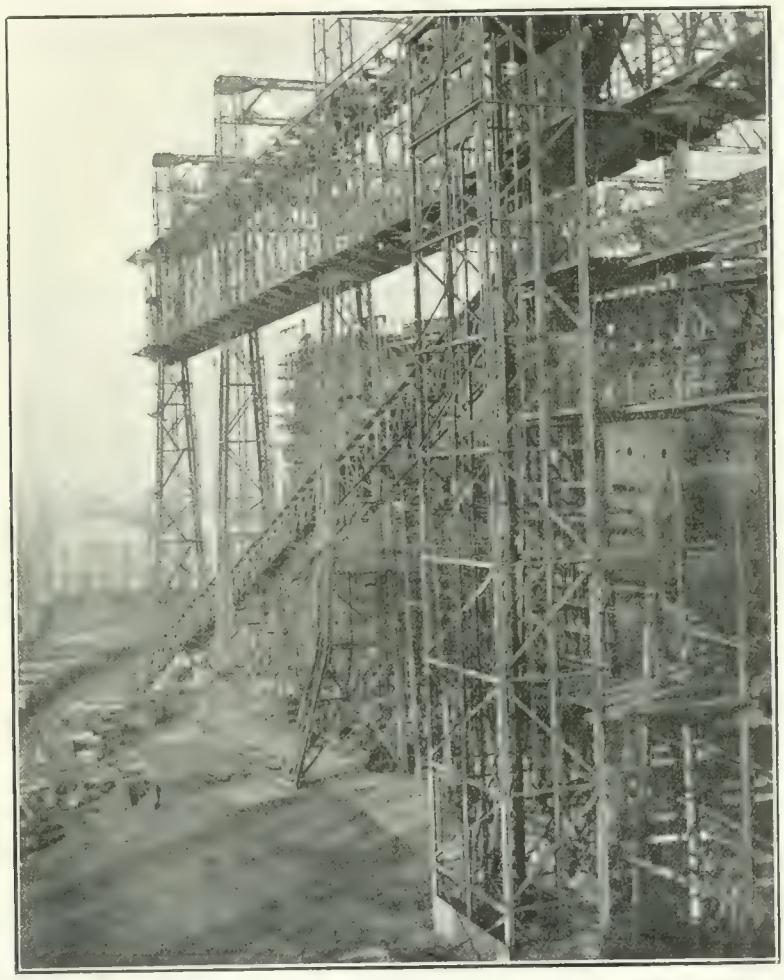


Fig. 8.—Waygood Lifts at Messrs. Harland & Wolff's Building Berths.
Messrs. R. Waygood & Co., Ltd., London.

See article "Modern Shipyard Machinery," page 2

The deal between Sir John Ellerman and the Shaw-Savill and Albion Company has naturally induced rumours of other combinations, and amongst them is a suggestion that a powerful interest is about to make an offer for the fleet of the New Zealand Shipping Company, which undertaking, like Shaw-Savill & Albion, has been largely increasing and modernising its fleet of recent years. A significant fact is the advance of the Company's shares to a premium. This may either be induced by a general idea that something is in the wind or may be caused by solid buying on account of those in the know. The New Zealand Shipping Company has of late been in the forefront of enterprise, for they were the Company for whom Messrs. Denny & Co., of Dumbarton, constructed the *Otaki*, the first vessel with a combination of reciprocating engines and turbines. They thus proved the adaptability of the system to vessels of moderate speed, and deserve the credit for doing so, though in some directions it is maintained that the *Laurentic*, built by Messrs. Harland and Wolff, for the St. Lawrence service of the White Star Line, was the pioneer vessel in this direction. A glance at the dates will determine this point once and for all, for the *Otaki* went through her trials in November, 1908, while the *Laurentic's* trials did not take place till January, 1909. The success of this experimental vessel has been such that the New Zealand Company have felt justified in having during the current month another steamer similarly engined, launched for their fleet from the Dumbarton yard.

The Mersey Docks and Harbour Board

has at length determined to commence work on its large scheme of dock extension, which was outlined some time ago. The idea is to eventually make additions to the facilities of the north end of the Dock Estate to an estimated cost of three and a half millions. But the present departure is but a part of the whole and it will involve but an expenditure of half a million sterling. It should, however, give to the trade of the port facilities which will be sought in vain in any other port. Liverpool can at present dock any vessel yet built or under construction. The new dock will give accommodation for vessels larger than any as yet even suggested. As the chairman rightly remarked, vessels of this huge class can hardly be completed in less than three years, and in three years the new dock will be ready. It will have a length of 1020 ft. with an entrance 120 ft. wide, whilst the level of the cill will be 25 ft. below the standard datum of the port—" the old dock cill." It will be available either as a dry or a wet dock, for the bottom of the dock will be laid in concrete and will be 4 ft. lower than the cill. Blocks for dry docking will be provided. On a twenty foot tide there will be 45 ft. of water at the entrance !

The Spread of Wireless

is—apart from legislative compulsion—very marked. I notice that the new steamship *Gloucestershire*, just launched for the Bibby Line service to Rangoon, is fitted with wireless, whilst the P. & O. is rapidly extending the installations to all the mail steamers of its fleet, the latest to be fitted being the *Mooltan*. Now the London and North-Western Railway Company is adapting its mail steamers for the receipt and despatch of wireless messages.

SIR RAYLTON DIXON & CO., LTD., of Middlesbrough, have presented to the Admiralty Registry in the Royal Courts of Justice a valuable model to scale of an up-to-date cargo steamer of 4580 tons gross. The model, which is 4 ft. in length, is enclosed in a handsome glass and mahogany case upon which is a suitable inscription.

MR. E. HAYES, of Stony Stratford, has recently run the trials of another twin-screw steel steam launch for export to the East. She is named the *Ekinji*, and is 60 ft. long, 11 ft. wide and draws 3 ft. aft.

ENGINEERING AND MACHINERY EXHIBITION, MANCHESTER. —The Right Hon. Sir George Reid, High Commissioner for the Commonwealth of Australia, has accepted the invitation of the Exhibitors' Advisory Committee to open the Exhibition on the 14th October. A meeting of the Committee was held recently, and was attended by many well-known persons. Details of the opening ceremony were completed, and other business attended to. The meeting was a very enthusiastic one. We learn that practically all the space in the Exhibition has been booked.

THE GRILLE WATER-TUBE BOILER.

WE have had an opportunity of personally investigating the merits of a Grille water-tube boiler, installed in the works of the well-known firm of Messrs. Fraser & Fraser, Ltd., of Bromley-by-Bow, E. The firm placing this boiler on the British Market is The British Grille Water-tube Boiler Co., of Craven House, Kingsway, London, who have made arrangements with Messrs. Fraser and Fraser, Ltd., for its manufacture.

The qualifications demanded for a modern boiler particularly for marine use is high efficiency with small weight and occupying small floor space, with facilities for cleaning, other than by manual labour, and further, that all parts of the boiler shall be open and convenient for repairs.

These qualifications are so well represented by the Grille boiler that it would appear to be almost a unique type, as the weight and floor space are small, as compared with other water-tube boilers, whilst it is self-cleaning as regards its tubes by a special arrangement, by using a reverse current of steam which is caused to flow at suitable intervals—say once a day—through every portion of its tubes. The boiler and its tubes can also be swung outwards by means of two

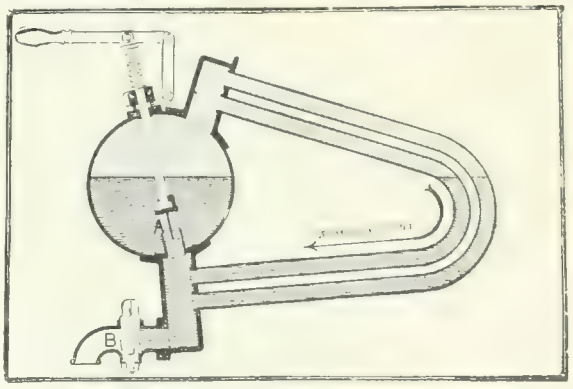


Fig. 2.—Illustrating the Reverse Circulation

supporting bars quite away from the brick-work foundation, allowing excellent access for repairs. Excellent testimony has been given as to the efficiency of the boiler, even under forced draught, to the effect that it always gives dry steam, even when working up to 3 times its normal evaporative capacity, and further, that the boiler will not prime at all, even when pressed to the utmost.

The Grille boiler has been at work at Messrs. Fraser & Fraser's works since May 17th, 1909, and tests have been made of its working, which prove its tubular element to be maintained absolutely clean and free from scale, although working with East London water, which has an average hardness factor of 20 degrees. The boiler has been cleaned by the sectional blow-down only, and sections of one of the tubes were shown at the demonstration, which had been taken out and cut into pieces. These were absolutely clean, showing the tube drawing marks upon them. Externally the tubes are kept clean by a steam blast from a nozzle, which can be applied through tubes placed here and there in the lower header, and there is no external sign whatever of burning in these tubes. Evaporation tests were made at the works six months

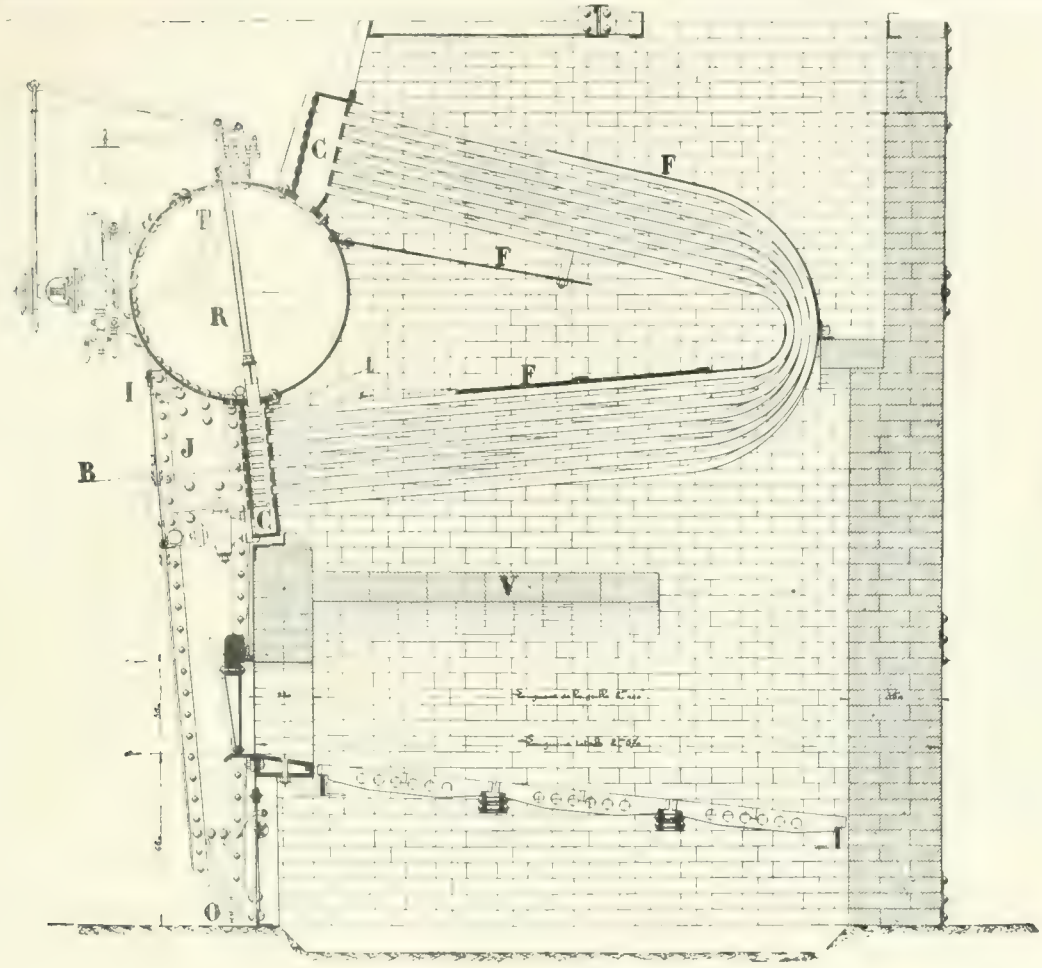


Fig. 1.

Sectional Elevation

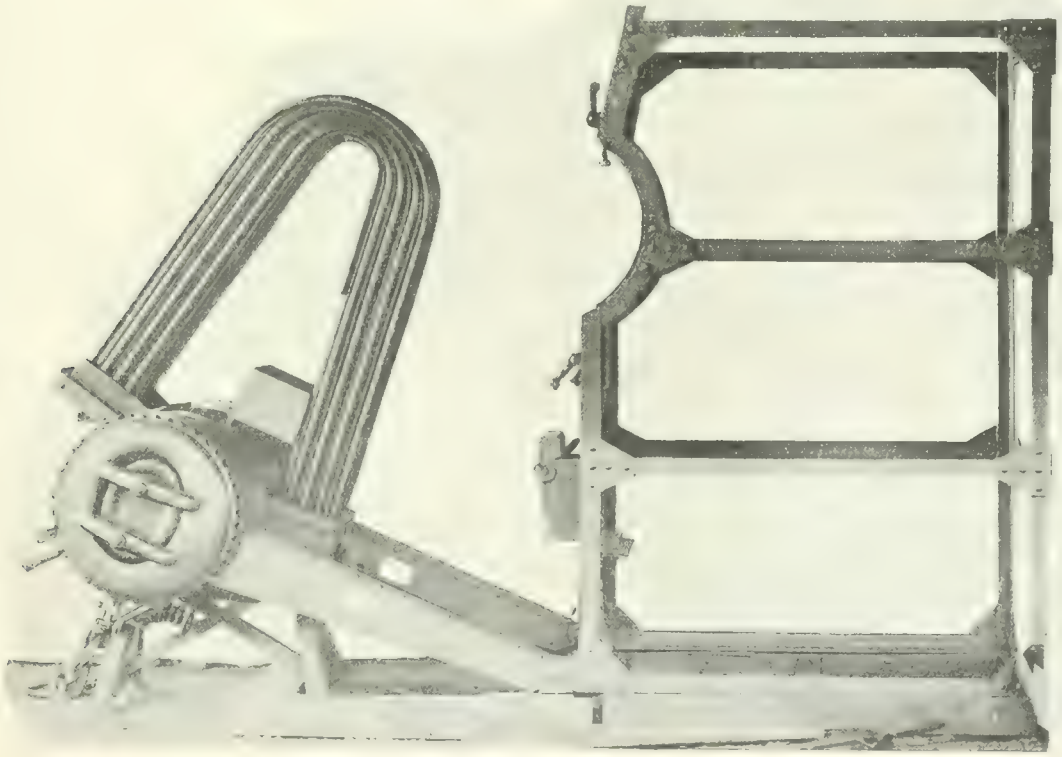


Fig. 3.

after the installation was put up, when it was found that an evaporation of 11·5 lbs. of water from and at 212° F. per lb. of coal was obtained, showing an efficiency of 80 per cent., and even when generating at 40 per cent. above the normal duty it was still found that the same efficiency was maintained.

Referring to Fig. 1, it will be seen the boiler consists merely of a steam drum R to which two headers CC are attached, having tubes of U form. This drum R is attached to the upper portion of two standards J pivoted at their bottom, by which means as shown in Fig. 3 the whole boiler with its tubes can be swung outwards away from the brickwork foundation, so that all parts are open and convenient for examination and for replacing tubes. This examination need only be done, say, once in six months, to effect which the flanges of the steam pipes and of the water supply must be uncoupled.

Baffle plates FFF are used to direct the course of the gases from the furnace to the flue, there being a reverberating arch V of firebrick above the furnace, to ensure smokeless combustion and the efficient combustion of the fuel.

A peculiarity of the Grille boiler is the system of Solignac Cartridges B, which are placed in each of the ends of the tubes attached to the lower head. These cartridges slide in the ends of the tubes and are made of thin metal with a small hole bored into and through the heads of the cartridges. As soon as there is some change in the internal pressure in the tubes, these cartridges keep on the move, coming partly out towards the end of a plug fixed into the outer wall of the header, but in going back to close the tube, they always leave the hole through them clear, so the water can only enter the tubes in a very restricted form, the change taking place continuously and uniformly. What the effect of these cartridges is upon the supply of water is still an open question, but we understand that it is only with these cartridges that this boiler can be made to give clean dry steam when pressed to an abnormal extent.

The boiler is made in sections of from three to eight in number, according to the size required, each section being provided with a blow-off cock at the foot of the lower header as shown in Fig. 1 and at B in Fig. 2. This last figure shows the arrangement used in these boilers to produce, when desired, a reverse circulation in the evaporating tubes. When the valve A is closed down from the outside, the supply of water is absolutely cut off from the lower header, so that if the blow-off cock B is opened the steam must blow down the evaporation tubes from the top of the boiler, first driving out the water, originally in the lower portion of the tube and in the lower header, and then scouring and cleansing the tubes by removing any deposited sediment therein. This blow-out may take place at any time, but even with water of a very high degree of hardness, it is not necessary more than once in twenty-four hours. Some marine boiler contracts have already been fulfilled, and in Fig. 4 we show the Grille boilers on the s.s. *Pas de Calais* and *Nord*. Amongst the first orders was one for four boilers, a part only of twelve boilers in the *Pas de Calais*. The French Naval Authorities have made exhaustive trials on the boiler as fitted on the torpedo boat *Kabyle*, and an efficiency of at least 76% at a normal condition of the fires, and with a rate of firing three times the normal the efficiency was found to be as much as 65%. The steam for the low as well as the increased combustion above referred to, had only ·0083 per cent. of water with it, which was a remarkable result.

Having regard to the result of these tests, the Compagnie du Nord considered the advantages of the four boilers on the *Pas de Calais* to be so evident, that, when considering the Grille design with that of other water-tube boilers, they determined to install all Grille boilers, to the number of twelve, in the *Nord*.

It is therefore worthy of note that the Compagnie du Nord have found these boilers all that could be desired for their Channel vessels, there being a distinct saving in the weight and floor space occupied in comparison with other water-tube boilers. As there is a boiler here in the hands of Messrs. Fraser & Fraser, Ltd., who have tested it in actual working for twelve months, marine engineers here would do well to take the opportunity of acquainting themselves as to the advantages of this boiler.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our Own Correspondent.)

Portsmouth Dockyard.

KING GEORGE has made his first visit to this port since his accession. His Majesty, who was accompanied by Queen Mary, embarked in the Royal yacht on July 21st and made an informal tour of the Government establishments, the dockyard, Whale Island, Harbour and the Marine Barracks. Their Majesties made a short cruise to Cowes, and then left on the visit to the Fleet, which was of quite a private character. Probably at the Coronation there will be an elaborate naval display at Spithead. The Lords of the Admiralty, too, came down at the end of the month. The battleship *Orion* is to be launched on August 20th by the Marchioness of Winchester, whose husband, the Marquis of Winchester, is the Lord-lieutenant of the county of Hampshire. The vessel will have been on the slips a week under nine months, which is about a fortnight longer than her predecessor, the *Neptune*. The *Orion* will be the heaviest battleship built here, her displacement when completed being 22,500 tons, but her launching weight will be about 8000 tons, the same as the *Neptune*. Her length is 545 ft. and beam 86 ft., and she is to be fitted with turbines of 27,000 horse power. She will carry ten 12-inch guns and the barbettes will be so arranged as to give a broadside fire of ten guns with eight ahead and six astern. The greatest secrecy is still being observed as to all that relates to the vessel and although hundreds of excursionists visit the yard daily none of them are allowed near the building slips. The *Neptune* is making rapid headway, and it is hoped to have the vessel ready for her trials by the late autumn, so that she may be ready for commissioning by January, or within two years of her commencement. All the turbines have been shipped and three of the barbettes with their guns and equipment are complete. At the dockyard sale on July 12th five obsolete warships were sold. The battleship *Barfleur*, 10,500 tons displacement, which was launched in 1892, went for £26,500, and a sister vessel, the *Centurion*, launched the same year, was sold for £200 less. The cruiser *Melampus*, a vessel of 3400 tons launched twenty years ago, was disposed of for £9000. It is interesting to note that the *Melampus* was commissioned by King George (then Commander the Duke of York) for the naval manœuvres of 1892. The *Nelson*, which was for some time a training ship for stokers at this port, was sold for £14,500. She was launched thirty years ago, and was originally a first-class cruiser of 7630 tons. The *Pique* only brought in £2500; she, however, is a hulk and was built seventy-five years ago.

Devonport Dockyard.

No fewer than forty vessels were brought up to sea-going strength for the manœuvres at this port. There have been two mishaps recently, strangely enough the vessels concerned being the present and past flagships of the local division of the Home Fleet. Shortly after relieving the *Sutlej* the *King Alfred* left for a cruise to the Channel Islands and almost immediately came into collision in the Channel with the steamship *Cheapside* of London, which was sunk, the cruiser sustaining no damage of moment. On July 15th, during the manœuvres, a boiler explosion occurred in the *Sutlej*, as the result of which four men were seriously scalded, two of whom died. It is satisfactory that no vessels returned from the manœuvres earlier than usual owing to machinery or other defects. Splendid progress is being made with the new cruiser *Indefatigable*, and it is confidently anticipated that she will be ready to commence her machinery trials in October. The cruiser *Lion* is to be launched on Saturday, August 6th, by Viscountess Clifden. The *Lion* will be the third vessel that Vice-Admiral Cross has superintended the launch of since he came here as admiral-superintendent. He leaves us in September, but it is not yet known who his successor will be. The cruiser *Europa*, of the Fourth Division of the Home Fleet, has been taken in hand for a refit, as has Torpedo-boat No. 045, and Torpedo-boats Nos. 99 and 107 have been taken in hand for the retubing of their boilers. The cruiser *Niobe* is now practically ready to leave for Canada. Although fifteen years have passed since she was laid down she looks as smart as ever she did. It has transpired that the price paid by the Canadian Government for the vessel was £215,000. The *Niobe* has been inspected by representatives of the Dominion Government, including Commander Macdonald and Engineer-Lieutenant Howe. Orders have been received for the 27-knot destroyer *Swordfish* to be transferred to the non-effective list. She was built at Elswick fifteen years ago and an examination has shown that her efficiency has been reduced to an extent which does not justify any further expenditure on the vessel. The destroyer *Mermaid* has been sent to Gibraltar, where she is to undergo a refit. The *Pique*, late a fifth-rate of 1811 tons, which was built in 1834 and last used as a hospital ship at this port, was amongst the vessels disposed of at the last dockyard sale at Portsmouth. The battleship *Hood* has been sent to Queenstown, where she has relieved the *Emerald* as receiving ship and flagship of Rear-Admiral Sir A. Paget, the senior officer on the Coast of Ireland. The *Emerald* is to be linked up with the *Impregnable* and *Inconstant* to form part of the boys' training establishment, and is to be renamed the *Impregnable III*. The *Emerald* was formerly an armoured cruiser, her original name being the *Black Prince*. Commodore Wemyss, of the Royal Naval Barracks, is, it is understood, to be in command of the mail steamer *Balmoral Castle*, which is to take the Duke of Connaught out to South Africa. A former apprentice at this yard, Mr. C. F. Rogers, obtained an Admiralty scholarship of £50 a year, tenable for three years, at the recent examination of private students of naval architecture for admission to the Royal Naval College, Greenwich.

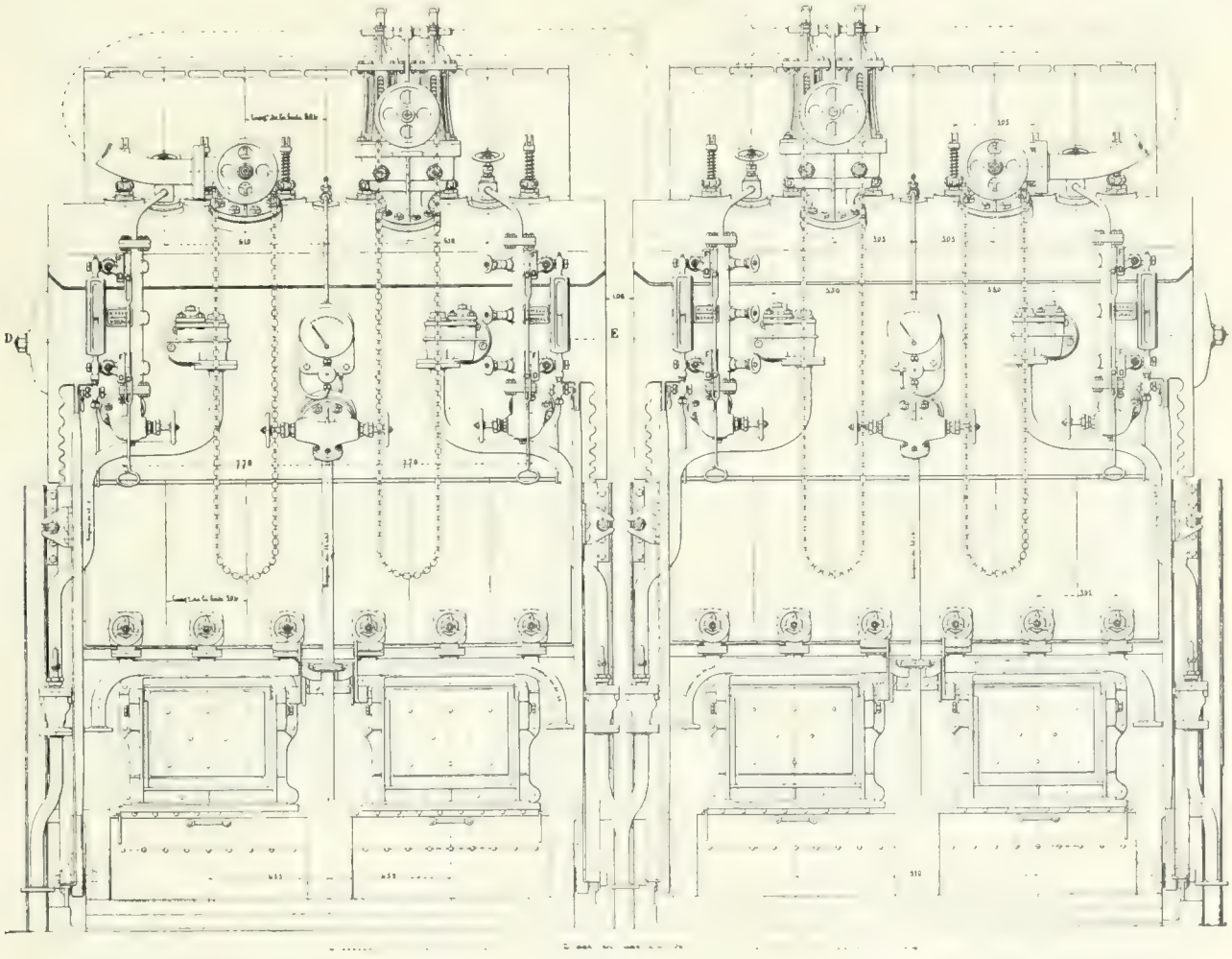


Fig 1.
Grille Boilers of S.S. *Pas de Calais* and *Nord*.

Chatham Dockyard.

The naval manœuvres give a large amount of work both to the naval and to the dockyard authorities, but, nevertheless, the mobilization was carried out without the slightest hitch and all the vessels were ready in good time. Practically every commissioned ship left the port for the exercises. We have still plenty of refitting work. The cruiser *Charybdis* has been taken in hand before leaving for Colombo on trooping duties, and the destroyer *Panther*, of the Nore Flotilla, has also been paid off for a refit. The destroyer *Eden*, which received extensive damage at Dover in January, when she parted from her moorings and was driven ashore, has been repaired and has been recommissioned for service with the Nore Flotilla. The ocean-going destroyer *Swift*, which had been in hand for the repair of some damage recently received at Birkenhead, left on July 2nd for Harwich to rejoin the First Flotilla. In connection with the transfer of the boy artificers from this port to Devonport and the mechanician candidates from the Western port to Chatham, the *Tenedos II.*, which has been used as the training establishment for boy artificers, was paid off on July 15th, the boys being transferred to the *Indus* at Devonport, and the mechanician candidates to the *Pembroke*. The *Tenedos*, which is an old wooden line of battleship, has now been placed on the non-effective list, and is to be sold. The cruiser *Naiad*, which has been converted into a mine layer at a cost of £30,000, has been completed. The Japanese cruiser *Ikoma* has paid us a visit and her officers, together with the Japanese Ambassador and other notable persons, have been entertained by Admiral Sir Charles Drury, the Commander-in-Chief at the Nore. Invitations were also extended by the Mayor to the members of the Corporation and the principal residents to meet the Japanese officers at a garden party. Everything possible was done to make the stay of the visitors a pleasant one. A well-known officer at this port, Chief Engineer-Artificer J. Medhurst, of the *Ranger*, died recently and was buried in the new cemetery at Gillingham with naval honours, the bearers being selected from the engine-room artificers of the Nore Flotilla. The coffin, which was borne on a gun carriage, was covered with floral tributes, including wreaths from the *Ranger* and *Pembroke* and the artificer engineers of the Nore Flotilla, and an anchor from the local branch of the Chief and Artificer Engineers' Benevolent Association.

Sheerness Dockyard.

The Medway has almost been deserted during the month, practically every ship having been away taking part in the manœuvres. Rear-Admiral Jerram, who has been for some time on special service with the Vice-Admiral commanding the Third and Fourth Divisions of the Home Fleet, had command of the Special Service Battleship Squadron, with his flag in the *Goliath*. After the manœuvres he goes to the Mediterranean to relieve Vice-Admiral Sir George Callaghan. The torpedo gunboat *Hebe* met with a mishap and returned to her native port after an absence of several years with her bows battered, the result of a collision in the North Sea whilst on her way to Dundee to commence duty with Section VII. submarine flotilla. It appears that just before ten o'clock on the night of July 1st a collision occurred off Orfordness between the *Hebe* and the steamship *Majestic* of Hull, the stem of the gunboat coming into contact with the port side of the steamer near her foremast. The *Hebe*, when she backed away from the steamship, was taking in water so fast that it was feared at first she would sink, but she managed to steam here unaided. When taken into dock it was seen that the damage extended from the forecastle deck to the keel, and the stem and several feet on both port and starboard side will have to be rebuilt. The destroyer *Waveney* also came in to have a leak in her shell room stopped, but the repairs only took a couple of days. The torpedo gunboat *Leda*, which is employed under the Admiral commanding the Coastguard and Reserves, has left after having been in port for a fortnight, during which she was dry docked. The three vessels of the First Destroyer Flotilla were got out of hand early in the month, the last to leave being the *Tartar*. Her refit included the strengthening of her armament from three 12-pounder quick-firing guns to five, the two additional guns being mounted amidships. At the time of writing the three submarines, *C1*, *C3* and *C4* are still in hand. The special service vessel *Magnet* arrived on July 13th from Portsmouth with six horse boats in tow, which are for use during the Army manœuvres. She took back with her two large air cylinders which were brought here for use at the salvage of Submarine *C11*. It has been announced that the floating dock which is under construction for the Medway is to be completed by the end of September of next year. Mr. Chatten, of this yard, the electrical fitter apprentice who obtained the highest marks at last year's examination of the Dockyard Schools, has been awarded the Admiralty scholarship in electrical engineering. He will go to the Royal Naval College, Greenwich, for a year's study and will receive £40 a year and the pay of a hired electrical fitter. Probably he may remain two years, as the scholarship may be extended at the discretion of the Admiralty.

Pembroke Dockyard.

It was anticipated that the cruiser *Blonde* would have been launched during the first week of July, but the event did not take place until the end of the third week, Lady Williams, wife of Sir Osmond Williams, being the lady invited to name the vessel. The postponement was so as to enable the engineer contractors to complete boring out for the propeller shafts and ship the shafts and propellers before the launch. It was not, however, found possible to ship the latter and this will be done while the vessel is in dock. The keel plates of the *Barrosa*, the first of the two new cruisers to be commenced here during the current year are to be formally laid on the blocks in No. 5 slip on July 27th (I am writing before that date). The vessel will be sufficiently advanced to afford employment to the men now engaged on the *Blanche* when that vessel leaves for her steam trials during August. The *Blanche* has been docked for the examination of her underwater fittings and to have her bottom cleaned and coated preparatory to the steam trials. She is to be commissioned in January and both she and her sister the *Blonde* are to be attached to the Nore Command for manning on their being passed out of hand as ready for active service. We are rapidly specializing in the construction of the new type of unarmoured cruiser of the *Boadicea* class. The first, the name ship, was laid down in June, 1907, and commissioned in June, 1909, just twenty-four months. The second, the *Bellona*, laid down in June, 1908, was commissioned in February last, a gain of four months. As to the *Blanche* and *Blonde*, laid down respectively in April and December, 1909, it is not likely that the former will be completed in less time than the *Bellona*, although it is quite probable that the *Blonde* may be ready in about eighteen months. The torpedo gunboat *Sharpshooter* arrived on July 2nd in a leaky conditon, and was dry docked, but the damage only took a couple of days to put right. A wireless message was received from the gunboat that she was leaking. The only dry dock was occupied by the *Blanche*, which was being prepared for her steam trials. The work of repacking the glands on the propeller shafts, which had been opened out for examination, and connecting up and closing down the valves on the other openings was completed in a couple of hours and the ship was undocked before the *Sharpshooter* arrived. Another vessel, the cruiser *Grafton*, came in on July 16th in a somewhat crippled condition, six of her ventilating fans having broken down. The destroyer *Foyle*, which has come round from Devonport for refit, is a comparatively new vessel, having been completed five years ago. The destroyer *Avon* is still in hand. Pembroke Dock has been quite busy during the past month, and never before has there been such an assemblage of war vessels. Altogether there were about thirty submarines here with their attendant vessels.

Naval, Mercantile Marine and General Engineering Exhibition.—This Exhibition, which is to be held at Olympia Sept. 1st to 26th, is being looked forward to by the promoters and intending exhibitors with pleasant anticipation. The space has been allotted to an extent which gives every hope of a successful Exhibition, and among the names of the firms who have booked space there are many who were not represented at the former similar show, while the preponderance of former exhibitors gives evidence that the last Exhibition was productive of good to those who spent money, time and labour in displaying specimens of their manufacture. We note that Saturday, Sept. 17th, is specially set apart for a visit from members of the Institute of Marine Engineers, when papers will be read in the Pillar Hall during the evening, and visitors are invited to attend.

NEW JAPANESE ARMOURED CRUISER "IBUKI."

THE fact that the *Ibuki* is officially designated an "armoured cruiser" is the sole excuse for including her under the same heading as the *Aso*, *Iwate*, and the rest of the cruisers proper. For all intents and purposes she is a battleship pure and simple as much as our own *Swiftsures* are, since she mounts heavier artillery, is better protected, and only steams a nominal 22 knots. However, as an "armoured cruiser," she has joined the Japanese fleet, and as such we propose to deal with her.

In actual fighting value she is on a par with the *Queen*, *Duncan*, *Mikasa* and *Deutschland* classes—

The *Ibuki*.

possibly superior to the lot, being a more modern ship, and therefore possessing those up-to-date internal fitments which do not show on paper, but possess a very real war value. In design she is a natural evolution of the preceding *Tsukaba* class, of which the *Ikoma* is now on a visit to English waters. Upon a displacement of roughly 1000 tons more, she carries eight 8-in. guns in double turrets upon the upper deck instead of twelve 6-in. in casemates, and steams 1½ to 2 knots faster. That the extra displacement has been utilised to the utmost is evident, and it speaks well for the construction staff that such an excellent all-round warship could have been designed upon smaller dimensions, and only twenty tons more legend displacement than our *Minotaur* class, which should have the same fleet functions.

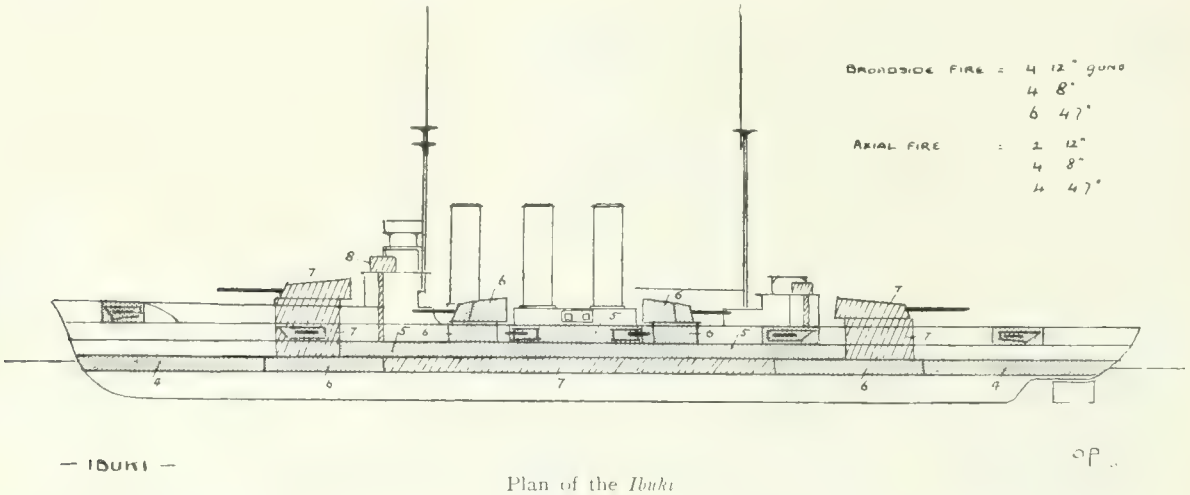
It will be remembered that during the Russo-Japanese war Togo utilised all his armoured cruisers as battleships, grouping them together as a fast wing squadron. As, however, they mounted nothing heavier than the 8-in. gun—except the *Kasuga*, which had a 10-in. piece forward—their utility as line ships was not of a high order. The two *Ibukis*, however, possess the essential 12-in. guns for long range action, and that extra turn of speed which has been proved to be so necessary for bringing the enemy's rear into battle under pursuing tactics.

Peculiarly enough it is only in the British, Japanese and German navies that the necessity for the "cruiser-battleship" has been realized; other nations have confined themselves to the battleship and *Scout* types as fulfilling all the requirements of modern naval warfare—apart from torpedo craft, of course—and yet the need for "Invincibles," "Ibukis," and the like seems obvious. Speed is essential for successful tactics, but in actual practice the service speeds of contemporary battleships will be all in the region of 19 knots. Thus the *raison d'être* of a fast wing squadron becomes almost a postulate. But what is going to be sacrificed in order that this extra turn of speed may be attained? Either protection or armament must suffer, and of the two the curtailment of offensive powers seems to be generally acknowledged as the best way out of the difficulty. It must always be remembered that a cruiser can only be a cruiser so long as she possesses the requisite speed, and for this reason she cannot afford to court battle with an enemy strong enough to damage her sufficiently to affect her steaming powers. But if your cruiser has a 7-in. belt like the *Ibuki*, as well as 12-in. guns, she can stand a lot of hammering without vital damage, and then if her *mêtier* as cruiser is lost owing to loss of speed through any reason, she still can take her place in line of battle as a battleship pure and simple. Should

protection be curtailed instead of armament, her use as a "battleship" would be greatly diminished. And yet drastic sacrifices must not be made for any one special preponderating feature in a ship—she must have guns, armour, speed and coal. It is in the happy mean that the successful type is to be found, and Japan is fortunate in possessing such excellent ships as the *Kurama* and *Ibuki*, which promise to fulfil all the multifarious duties of the "cruiser-battleship" in a most satisfactory way.

From the plan it will be seen that the bows are of the peculiar "swan" shape, such as our *Adventure* class have to some extent. The exact reason for the adoption of this shape is uncertain; to some extent it may be "drier," but it is certainly not as strong as the "semi-ram" bows of our own ships. Perhaps there may be something in the suggestion that the differs from the original design inasmuch as these 8-in. guns are carried in four double instead of eight single turrets. The 4·7-in. guns forming the main-deck battery are rather unhappily placed, as their command is greatly restricted. It will be noticed that a salutary battery of 14-pounders is carried amidships, there being no light quick-firing guns round the bridges and covering towers as in British ships; this is probably due to the interference that might otherwise be caused with the search-light operators, the projectors being grouped round these positions.

No more vessels of the *Ibuki* class are being built, as the ever-increasing size of and speed of battleships has necessitated a further rise in dimensions. Hence the *Huki* class which have followed them will be more like our "Invincibles," although accurate details are wanting at present.



Plan of the *Ibuki*

ships will have a distinctive appearance by which the mistaking of friend for foe will be to a great extent militated against. In Semenoff's book, "Rasplata," we read how the Russians could rely upon the similarity between the *Diana* and the Japanese *Iwate* to help them out of tight corners at times, whereas the *Ibuki's* "swan" bows would have done much to have counteracted the other external common features of the ships.

The *Ibuki* was laid down in May, 1906, and her construction has been somewhat delayed owing to various reasons—financially to some extent, but mainly through a desire to complete the re-construction of the captured Russian ships.

She is fitted with American Curtiss turbines, and the full account of her trials will for this reason be of interest, as with the exception of the U.S. *North Dakota* she is the only large warship to be so equipped. It will be remembered that our *Bristol* ("Town" class) is being experimentally fitted with this type of turbine. The *Miyabara* boilers are of the small tube variety, the utility of which has been severely questioned in many quarters.

A word as to the secondary armament of the ships. There has been a rumour going the round of the Press that the 8-in. guns have been taken out and two 12-in. substituted instead. This we can emphatically deny; the ship is as here shown, and only

PARTICULARS OF THE "IBUKI" CLASS.

Name	*Builder*	*Laid down*	*Completed*
Kurama	Yokosuka	August, 1905	1909
Ibuki	Kure	May, 1906	1909

Displacement 14,620 tons

Dimensions: Length, 450 feet (Water-line).
Beam, 75½ feet.
Draught, 26 (mean).

Armament Four 12-inch in 7 turrets.
Eight 8-inch in 6 turrets.
Fourteen 4·7 inch in 5 inch battery.
Four 14-pounders.
Four submerged and one stern above water torpedo tubes.

Armour Belt, 7 in. amidships, 4 in. fore and aft.
Armour deck, 2 in. Conning towers, 8 in. fore, 6 in. aft.

Machinery. *Kurama* two sets reciprocating, two screws.
Ibuki Curtiss turbines.
Miyabara boilers, designed H P., 25,000 = 21·25 to 22 knots.
Coal: 600 tons normal, 2,000 tons maximum.
Electric hoists to 12-in. and 8-in. guns.
Complement 815

THE new Cunarder *Franconia* was launched on the 23rd July, at Messrs. Swan, Hunter, and Wigham Richardson's yard, Wallsend-on-Tyne. Her principal dimensions are:—Length, 625 ft.; breadth, 72 ft; depth, 90 ft. from top of houses to keel; gross tonnage, 18,000; displacement, 25,000 tons; height of funnels, 140 ft. above lowest furnace bars; diameter of funnels, 17 ft. 6 ins.; height of masts, 200 ft. above the keel.

MESSRS. MOSSES & MITCHELL, of Golden Lane, have admitted Mr. John Wood, junr., as a partner in their firm.

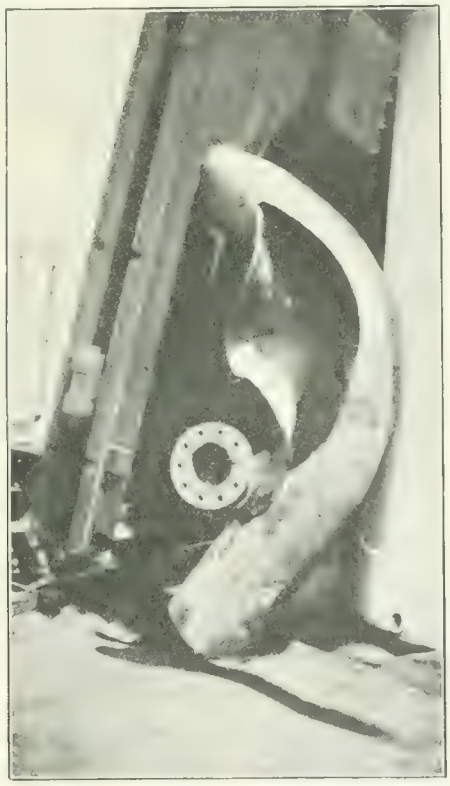
REPORT ON BURST STEAM PIPE.*

THE following report of an interesting case of the bursting of a copper main steam pipe, illustrations of which are appended, may be of service and interest. Unfortunately, the explosion was attended with the loss of five lives, and, but for the resources and skill of the chief engineer, the possible loss of a large steamer and valuable cargo might also have been recorded.

The accident occurred to the Southern Pacific Co.'s steamer *El Alba*, of New York, 4,614 tons gross register, on April 23, 1910, shortly after leaving Galveston, Texas, while on a voyage from Galveston to New York. After the accident the main engines stopped, as the burst pipe was in the main line of piping between the engine stop-valve and the branch pipes from the three main boilers. The chief engineer and his assistants drew the fires and set to work to rig up a temporary pipe in order to enable the vessel to reach a port; they disconnected three 3-inch ash hopper pipes, made some alterations in the lengths without having recourse to brazing, put iron flanges over the flanges of the main steam pipes, connected up the 3-inch pipes and raised steam; the vessel made about three knots and was enabled to reach the entrance to the Mississippi River, where she got in touch with the pilot, and, with the assistance of tug-boats reached New Orleans.

I was associated with Mr. Wilson—the non-exclusive Surveyor for the American Record Classification Society—in making a damage survey on this case. Temporary repairs were effected at this port, and the vessel subsequently reached New York.

The pipe was in the fiddley of the after stokehold, the opening was 33 inches in length by 17 inches in width, the pipe has an elbow bend, is 11 inches in diameter by 15 feet in length, and lap brazed; the thickness of the copper at the fracture varies between ·305 and ·315 inch; the fracture runs parallel, and is close to the brazing. The metal along the line of fracture is very crystalline in appearance. The chief engineer—who has been in the ship since she was built—stated that the main steam pipes had not been annealed since they were made (about nine years ago). I suggested to Mr. Wilson—Classification Surveyor—that he make the recommendation as a condition of class that all main steam pipes be annealed and tested, and as a further safeguard, although not a condition of class, that iron bands be fitted on the main steam pipes, spaced about three or four inches apart.



*Contributed by Mr J. M Buchanan (member) to the Institute of Marine Engineers' August issue of Transactions.

MESSRS. IRVINE'S SHIP BUILDING AND DRY DOCKS CO., LTD. have recently established a City office at 35, Bucklersbury, and have appointed Mr. Francis F. Hill, M.I.N.A., their sole representative in London.

LLOYD'S SCHOLARSHIP.—The Lloyd's Scholarship this year, in connection with the Institute of Marine Engineers, has been awarded, as the result of examination, to Mr. J. W. Boyle (Graduate), of Forfar, at present serving his apprenticeship with Messrs. Rankin & Blackmore, Greenock. He will take up his studies at Glasgow University during the forthcoming session. The Scholarship is tenable for two years, and is £50 per annum.

NOTES ON A BOILER EXPLOSION.

IN dealing with the above subject it is not my intention to go scientifically into the subject or to propound any new theory, but it struck me that the plain facts recorded may be of some use to those in charge of steam boilers.

The explosion to which I shall refer took place in the Essequibo river of this colony at a point about 100 miles from Georgetown, in the interior, on April 9, 1907. A very unfortunate affair, as a properly certified assistant superintendent engineer had been appointed to this station only four months before.

Description of Boiler.—The boiler was in use on a launch, 60 ft. long, 10 ft. beam, single cylinder, high pressure engine, the boiler single ended marine return tube, 6 ft. in length over front and back plates, 3 ft. 8 in. external diameter, single plain furnace tube 4 ft. 9 in., over all in length and 22 in. internal diameter with return tubes 2 in. external diameter, and 4 ft. long. The boiler was formed by a single steel plate $\frac{5}{16}$ in. thick and jointed by one longitudinal doublet riveted lap seam, rivets $\frac{7}{8}$in. diameter, $2\frac{1}{4}$ in. pitch placed zigzag. The front and back plates were braced by two stays, $1\frac{7}{8}$ in. diameter, the combustion chamber was secured to the shell in the ordinary way by screwed stays. The working pressure was 100 lbs. per square inch, and the fuel used was wood.

On the day of the explosion the launch left Rockstone with two boats towing alongside ; in one of these one ton of gunpowder formed part of the cargo. When information was received of the accident, it was immediately surmised that a spark from the funnel must have fired the gunpowder. Three men lost their lives, the captain, engineer and fireman ; fortunately there were only seven people on board on this trip. Sometimes there are as many as fifty passengers. It happened so suddenly and with such terrific violence that no coherent account could be got from the survivors.

The wreck was raised and brought to Rockstone to settle the doubt whether it was the boiler or the gunpowder. It proved to be the boiler and the damage done may be seen from the accompanying photographs which were taken by myself.

On examining the boiler I found the interior in first-class condition, no corrosion worth mentioning was to be seen, so it was evident that the explosion was not due to wasting of the plate.

As the photograph shows, the shell plate was rent from front to back and likewise in the two circumferential joints, throwing back the shell plate outwards and downwards on the starboard side of the launch, at the same time forcing the boiler off its seat and turning it about a quarter towards the port side.

From examining the edge of the plate I concluded that the direct cause of this explosion was a fracture in the shell plate along the longitudinal lap seam on the port side of boiler, because the edge of the plate showed two distinct forms of fracture, the inner part clean cut and the outer ragged, which pointed at once to grooving or nicking. The plate was not wasted, the full thickness measuring up to the fractured edge, caused no doubt by the indirect straining that exists at lap joints, owing to the tendency of the internal pressure to make the boiler assume a perfect cylindrical form and the variations of pressure to cause the groove or crack to develop more or less rapidly.

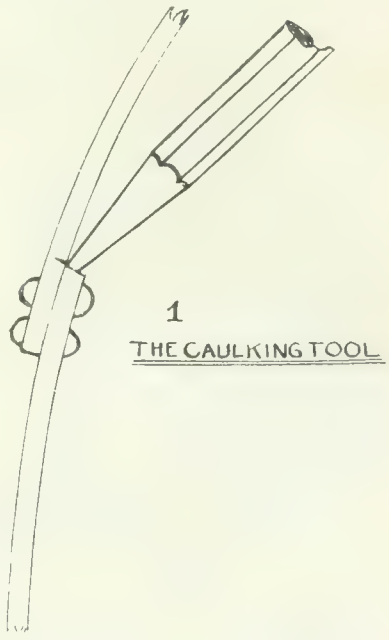
The detection of a defect of this kind would be extremely difficult, as the size of this boiler was too small to allow any visual examination to be made. In this particular case there is a probability that in the first instance the caulking tool hastened the grooving by nicking the plate (see Sketch No. 1).

In the middle of the longitudinal fracture the groove had penetrated through the plate some $\frac{1}{2}$ in. gradually narrowing towards both ends (see Sketch No. 2) the middle of the rupture being bulged outwards.

Taking the longitudinal seam as a girder supported at each end with a load evenly distributed, naturally any movement caused by internal pressure would be greatest at the centre, which would account for the ruptured edge being bulged and likewise causing it to be the first point to give way. Once that part of the shell plate had been separated, it is easy to conceive how the initial fracture was continued through the other parts of the shell by a pressure that would be insufficient to start the rent. The expansion of a volume of steam at a high pressure from a large body of water at a high temperature would force the plate forward with great force, flattening out the shell plate as shown in the photograph, causing the rupture to pass through front and back plates, shearing plate, rivets and rivet holes according to the position of the line of least resistance.

Testing.—At the subsequent inquiry there was much contention as to the value of the hammer test and the hydraulic test, the majority leaning towards the hydraulic. I should be pleased to know the members' opinion on this. I contend it is quite possible to pass a fracture of this sort relying on the sound given out by a blow of the hammer ; if the crack is not quite through it will scarcely affect the sound given out (see Sketch No. 3).

I have about thirty land and marine boilers under my care, and in the workshops, which we claim to be the largest in this part of the world, we undertake repairs to boilers, machinery, etc. It happened that two boilers of a well-known water-tube make belonging to an outside company were placed in our hands for repairs. Grooving was suspected in the upper or steam drum ; this was discovered by the engineer-in-charge when attending to some valve at the top, having felt a leak of steam blowing against his leg. The boiler was shut off, orders were placed with us to *caulk* the leak, the hydraulic pump was applied to locate the spot. When full pressure was applied not a sign of leak showed itself ; the engineer-in-charge then struck the plate with his hammer. Immediately a thin sheet of water escaped through the plate at the edge of the lap joint and disclosed the groove or crack ; this sounds very peculiar but it is true (see Sketch No. 4). This was repaired by a double butt strap after cutting away the fractured lap edge.



1

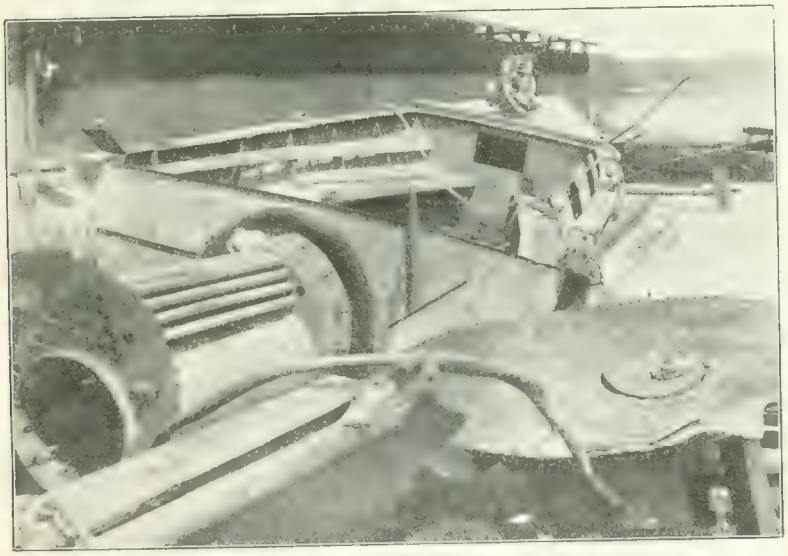
THE CAULKING TOOL

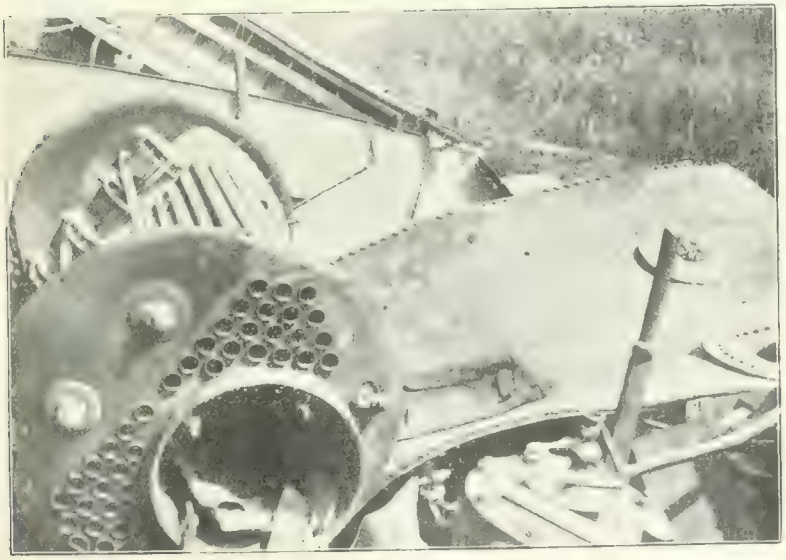
In the case of the second boiler (they were sold by auction) the same defect was found and treated in a similar manner ; both boilers are working at the present day.

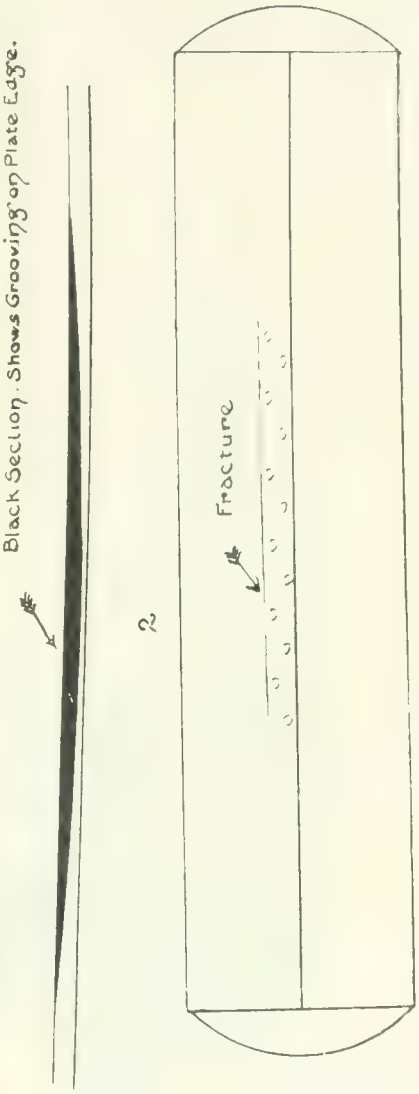
In consequence of these occurrences I submit that individually the hammer or hydraulic is not a reliable test, but should be applied together, rapping the plate with a hammer at intervals as the pressure is increased. This applies more to small boilers where the dimensions are not sufficiently large for a man to get inside to inspect them.

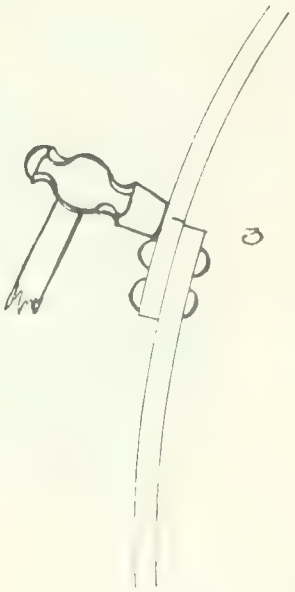
This explosion referred to was the third of a series which took place in this colony within a short period, the first being a vertical boiler used in a rice mill, the second a locomotive boiler. The age of the launch boiler was eleven years.

*Contributed to the Institute of Marine Engineers by Mr. C. J. Maggs (Member), Demerara. June issue of Transactions.






Black Section. Shows Grooving on Plate Edge.
2
Fracture
4 Top or Steam Drum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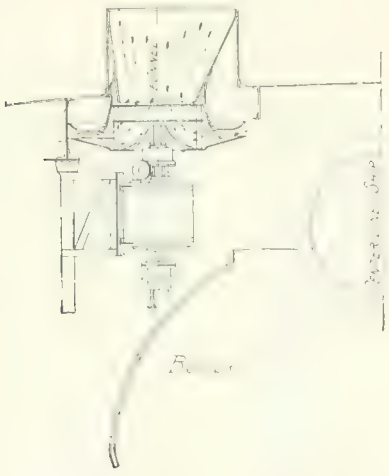
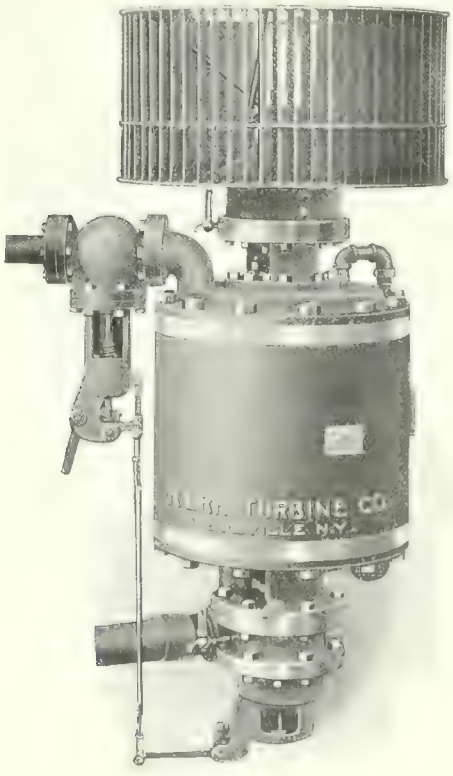
IMPROVED VERTICAL TURBO-FANS FOR FORCED DRAUGHT ON SHIPBOARD.

THE 50-h.p. seven-stage vertical turbo-fan, which we illustrate, is one of eight designed by the Kerr Turbine Company, of Wellsville, N.Y., for supplying forced draught to the boilers of the United



States torpedo-boat destroyers *Sterrett* and *Perkins*. These turbo-fans operate at a maximum steam pressure of 265 lbs. and non-condensing against 5 lbs. back pressure. The fans, of the American Sirocco



type, are placed to take air from the outside through funnels on the deck and discharge it into the fire-room through adjustable cone-shaped casings. Two fans, each operating at 1,655 r.p.m., deliver 40,000 cubic feet of free air per minute into each engine-room, maintaining within a pressure equivalent to four inches of water.

The installation arrangement is shown in the line diagram. The turbines are made right and left and are arranged in pairs, one pair delivering into each fire-room. One unit is bolted directly on to vertical stanchion on each side of the boiler. It is evident from the diagram that the space restrictions are quite severe. Small diameter of the turbine is an important requirement, and this was made possible, without reducing the power below the desired limit, only by using seven rotors, each twelve inches in diameter. The use of many stages with light rotors of small diameter in these turbines also overcomes trouble from gyroscopic action better than using fewer rotors of larger diameter. Experience has shown that in marine work the gyroscopic action of large heavy turbine wheels, running in a horizontal plane and with bearings close together, subjects the bearings to heavy side pressure as the boat rocks.

The effect of gyroscopic action is made negligible with the smaller wheels, and is further minimized in these Kerr turbines by the comparatively long distances between the bearings.

Kerr turbines have met with great favour for driving electric generators on shipboard and for driving marine auxiliaries, because of their economy, compactness, reliability and the absence of oil from their exhaust. A turbine is always clean in appearance and seldom requires attention. The test economy is maintained indefinitely, as there are no internal parts to rub and wear. This is of special advantage in driving fans and pumps, where the grinding of dirt and cinders on the rubbing surfaces of a reciprocating unit would render more attention necessary.

A NEW TYPE HIGH-SPEED BOAT.

VERY interesting trials have just been carried out on the Thames with an entirely new type of boat, which is the outcome of a large number of model experiments which Sir John Thornycroft has been carrying out during the last twelve months.

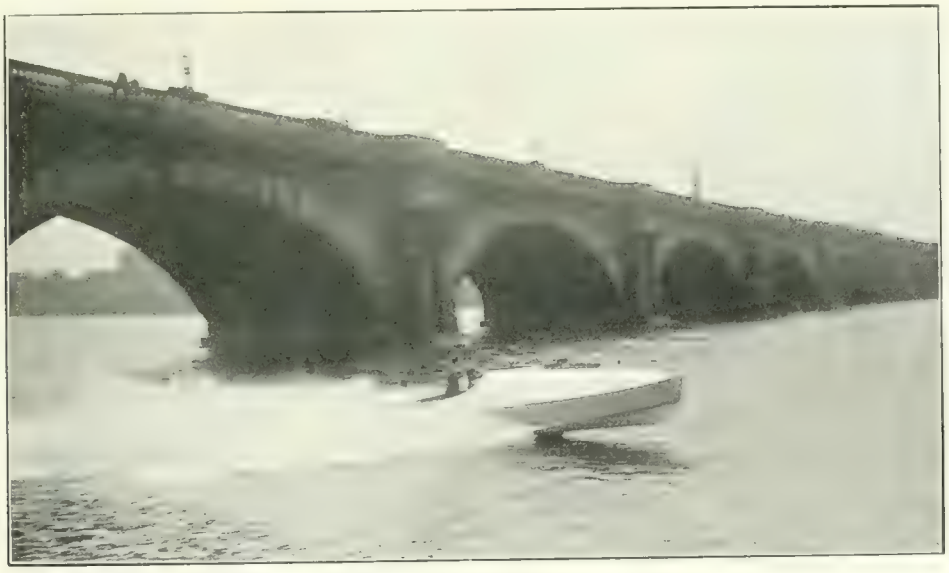
Much has been heard of the exceptionally high speeds attained by the modern hydroplane type of boat, but until now no practical seaworthy craft has been produced utilizing this principle. Nearly forty years ago, when Mr. Ramus first approached the Admiralty with his hydroplane (which he then called his polysphenic, or many-wedged ship), Sir John Thornycroft was experimenting with boats intended to skim on the surface, but at that time there was no machinery light enough to enable the principle to be practically applied. The development of the motor engine has made it possible during the last year or two to make hydroplane boats rise out of the water and skim along the surface. The difficult problem, however, has been to produce a form which is sufficiently like an ordinary boat to run without undue resistance at moderate speeds, and when going at high speed in rough water to be equally seaworthy as an ordinary boat.

This result has, however, been achieved in a most satisfactory way in this design; the boat, when seen at rest, would appear in every way to represent a good wholesome type of rather beamy boat, and when running at moderate speeds it is still difficult to see anything unusual about her. However, as soon as she gets up to a high speed, it is seen at once that there is a curious section given to the bottom of the fore body, which section dies away amidships, where there is a sudden change of form, the lines of the after part of the boat being quite hollow and terminating in a flat form

of stern, which is slightly wider than the section a little before it. The effect of this form is that the boat very readily rises up right on to the surface of the water, only touching it on a small area amidships and again just at the stern, so that skim friction and wave-making are almost entirely eliminated, while at the same time there are no flat places in the bottom of the vessel, which would be liable to be damaged in rough water when the boat was going at high speed from wave to wave.

The boat, which has been tried on the Thames, has been named the *Miranda IV.*, one of the very first of Sir John Thornycroft's boats, which made a record performance about thirty-five years ago, being his first *Miranda*. The present vessel is only 26 feet long, and has proved herself capable of a speed of well over 30 knots with five passengers on board.

Enquiries will naturally be made as to how far it is possible to apply this principle to large vessels; unfortunately there is not the least chance of ocean liners being able to skim, but it is thought quite possible that for the smaller vedette boats, and, for certain purposes, small passenger vessels might be built utilizing the principle.



A new type of High-Speed Boat.

MESSRS. SMITH, MAJOR & STEVENS, LTD., of Battersea, have found it necessary, owing to their growing needs, to provide new works, which are now in course of erection at Northampton.

TURIN EXHIBITION.—During next year, an Exhibition is to be held at Turin similar to that now being held at Brussels. The Royal Commission for the promotion of British interests in connection with Exhibitions desires that attention be called to the advantages of such, and we take this opportunity of acceding to the wish expressed by this department of the Board of Trade.

OUR ANNOUNCEMENT.—The 33rd annual volume of "The Marine Engineer and Naval Architect" begins with this issue, and affords a favourable opportunity for intending subscribers to send in their names. They are respectfully referred to the form printed on page xxii., which should be filled up and sent to the office at 3, Amen Corner, London, E.C. The annual prepaid subscription is 7/6, including postage, sent direct from head office to any address.

The 32nd volume, tastefully bound, is now on sale. 486 pages of good reading matter, price 7/6, or by post securely packed, United Kingdom and Canada, 8/-; other countries, 8/6. Binding cases may now be obtained from the publishers, price 1/6, carriage 3d. extra. A complete index to volume xxxii. is presented with this number. We shall be pleased to undertake the binding of readers' parts in publishers' cases at 2/6 per volume. Prices for other bindings quoted for on application. Back numbers in stock.

REVIEWS.

Experimental Applied Mechanics for Technical Students. By James L. Maxim, B.Sc. Longmans, Green & Co., London, New York, Bombay and Calcutta. Price 2/-.

THIS is a small treatise on applied mechanics containing 176 pages, and has been specially written owing to the fact that the Board of Education has recently revised the syllabus of applied mechanics, and in view of such revision the present appears to the author to be an opportune time for issuing a laboratory book of this nature. This book has been written by a teacher for students particularly with reference to the line of development of technical education as indicated in the syllabus above referred to. It is clear that the main object of the author is to instil into the mind of the student that he must learn mechanics by his own observation and not by what he is told or what he reads, and in this way will not only train his mind to ascertain the effects by direct experiment, but to deduce the principles on which the results are based so that he becomes fully acquainted with the actual theories of the formulæ he has to work with, and thus obviate the rough and ready methods of rule-of-thumb procedure. The book is divided into ten sections, as follows: Mathematical Introduction; Statics; Friction; Simple Machines; Transmission and Conversion of Motion; Properties of Materials; Dynamics; Work, Energy and Power; Hydraulics, or the Mechanics of Fluids; Roof Trusses, Bridges and Arches. Many of the experiments outlined are illustrated by diagrams showing simple apparatus, which the student himself can construct and experiment with in such a way as to appreciate the various factors in any particular problem. Each section is provided with a set of practical test examination questions, which the student can work out as a test of his knowledge of the substance included in any section. A short appendix includes tables of useful numbers in relation to mensuration, properties of materials, gauge numbers, coefficients of friction and tables of logarithms. We strongly commend the book to students who really want to carry out their training in a thoroughly methodical and scientific manner. We congratulate the author upon the conciseness of the matter presented.

Steamships and their Story. By E. Keble Chatterton. Price 21/- nett. London: Messrs. Cassell & Co., Ltd.

MESSRS. CASSELL & CO., LTD., have recently published "Steamships and their Story" by the author of "Sailing Ships and their Story" published last year. The story of the ship is taken up from the time when the picturesque sailing ship had, owing to the demands of time and reliability,

to give place to the steam-propelled vessel. The period occupied by steam propulsion and its development covers about one hundred years, and in that time great changes have taken place, and in the history of ships of any kind there is nothing comparable to the revolution which has taken place during this time. Consequently the story of the steamship is just as fascinating as that of the sailing ship. The plan on which the author has worked has been to give the historical continuity of the steamship from the most reliable and authoritative material obtainable, and to show in plain non-technical language how the steamship idea began; how it developed, and the principles underlying the building and working of the steamship. The volume will be found of the greatest interest, not only to those connected with maritime matters, but also to the general reader, who will find everything he could wish to know about steam vessels. The book is printed on good quality paper, contains 340 pages, with 153 illustrations, a frontispiece in colour by Mr. Charles Dixon, and is well bound. The illustrations will be found very interesting.

Die deutsche Schiffbauindustrie. By Dr. Josef Neumann. Leipsic: Dr. Werner Klinkhardt.

This is a volume of about 190 pages dealing with shipbuilding in Germany from an economical aspect. It shows the development of the industry from the yards of the ship-carpenters of the wooden ship era to the large yards devoted to the construction of the enormous steamers of our times. The author deals largely with the organization of the workmen and staffs, their position and remuneration.

CATALOGUES.

The Skefko Ball Bearing Co., Ltd., containing, in a well got up catalogue, particulars of their self-aligning ball bearings.

Messrs. C. E. Lugard & Co.—The "Pillow" flexible coupling.

The Cowper-Coles Galvanizing Syndicate, Ltd., relating to their cold regenerative galvanizing process.

Messrs. J. W. Brooke & Co., Ltd.—Extracts and letters on the Brooke motors, arranged in a dainty pamphlet.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our own Correspondent.)

Wages Advance.—The wages agitation, which has been proceeding amongst various branches of Clydeside artizans, and which, as far as local associations were concerned, were partially set at rest by the pledge on the part of the Federation employers to concede an advance of a farthing per hour or a shilling a week on September 7th—has now apparently been further solved by the result of a central conference held at York on July 15th. The whole question has been much too complicated, and the situation has varied too frequently, to render it possible to trace the movement in a monthly statement; but the position as left by the York Conference may now be summarized. The Clyde reference on wages consisted of the appeal of the engineers against the refusal of the North-West Employers' Association to concede to them an immediate advance of a farthing an hour, or a shilling a week. The employers offered the advance, but stipulated that it should not take effect until the first week in October. There were repeated adjournments in order that the parties might consult the local representatives. The representatives of the men held out in the end for a concession of the advance on the same date as the advance conceded to the minor trades, *viz.*, September 7th. The representatives of the employers adhered, on the other hand, to their offer of an advance in the first week in October. Ultimately on a compromise being suggested, they slightly modified their attitude of reluctance to give way and, apparently to the general satisfaction, agreed to make the increase effective on September 21st. This, then, became a mutual recommendation from the central conference to the local associations of employers and employees and the districts of the trade unions. It is hoped and believed that local feeling may accept this solution of the disturbing wages unrest.

Work and Play.—Most of the large industrial establishments in and around Glasgow and the Clyde closed down their works on July 15th for the annual "Fair Holidays," under conditions of more than normal prosperity. Two of the leading industrial establishments, at least, Messrs. Beardmore's huge works at Parkhead and the Steel Company of Scotland at Blochairn, suspended operations in the midst of a spell of brisk trade which limited the duration of the holidays compared with the period granted in duller years. The heavy demand for ship-plates, forgings and castings, etc., recently has kept both establishments going briskly. Messrs. G. & J. Weir, of Cathcart, and a number of other engineering concerns have had to extend the holiday period they had fixed upon, at the workmen's earnest request. To the workers holidays in these circumstances have, in all likelihood, proved more enjoyable, since their minds would be free from concern as to the prospects of steady employment when they returned.

New Work.—While the period since last month's notes were penned has been ordinarily fruitful in launches and trial trips—torpedo destroyers figuring somewhat prominently—the fresh contracts placed have been few and unimportant. The new orders of most note were those secured by Messrs. Caird & Co., Greenock, for two large intermediate steamers for the Lund Service of the P. & O. Co. Competition for these vessels was somewhat keen.

The London and Glasgow Shipbuilding and Engineering Company, Ltd., Govan, who have now most successfully put through all her trials—with the exception of a two hours' test under weather conditions at sea—the 27-knot destroyer *Rattlesnake*, are in the thick of extensions and reorganization of their works which, when completed, will render them thoroughly up-to-date as a naval shipbuilding and engineering establishment. On the ground acquired by the Company some time ago, which was formerly the shipyard of Messrs. Robt. Napier & Sons, and, therefore, the site upon which many notable vessels were brought into being, they are laying out new building berths and workshops, as well as constructing a tidal basin for the outfitting of naval as well as mercantile ships. Hitherto the vessels from their stocks have been accommodated, not without much inconvenience and risk, on the river alongside the yard. One building berth is being provided which will be capable of accommodating vessels of the largest dimensions and heaviest tonnage now built. It will have a length of 700 ft., and be suited to vessels of 80 to 100 ft. beam. Concrete and timber piling are being largely used for foundation work. The berth is disposed obliquely to the line of river, and in such a way as to afford good launching run. The tidal basin is to be 750 ft. long by 270 ft. at the mouth. It will have a depth of water equal to 29 ft. at the lowest tides, and thus conform to Admiralty stipulations as to vessels of the largest size being always kept afloat while fitting out. Crane accommodation will, of course, also be a feature at the new basin, but the nature of this is meantime undecided. At the present time, also, the London and Glasgow Company are busy increasing the size of their engine shops to about double the previous size. The extension consists of a fine shop, to be devoted entirely to erection work, also an extension of about double the original size of the machine shop. In these shops there will be installed new plant in the form of planing, turning and other tools, to deal with engine work of the largest class; and included in the plant are special lathes for turning the rotors and other parts of turbine engines. Most of the new tools are being made by Messrs. Thos. Shanks & Co., and other machine tool makers, Johnstone. The steel constructional work of the new shops is by Messrs. A. & J. Main and Arrol's Roof and Bridge Co., Glasgow. The contractors for dock construction, etc., are Messrs. Kinnear & Moodie, Ltd., Glasgow.

Proposed "Dreadnought" Dock.—The proposed new graving dock for the Clyde was referred to on July 11th at the meeting of the Glasgow Chamber of Commerce, and some misapprehension seems to exist as to the precise position of affairs as regards the scheme. At the beginning of last year the matter was remitted to a special committee of the Clyde Trustees for consideration and report. Tentative plans for the construction of additional dock accommodation and a

large graving dock, measuring approximately 1000 ft. by 100 ft., on the Trustees' land at Renfrew were prepared several months ago, and, as a matter of courtesy, the plans were submitted to the Admiralty. In returning the plans the Admiralty stated that the dimensions and sight were likely to be suitable for their utmost requirements. The scheme is still under the consideration of the special committee, and nothing further will be done until the committee submit their report to the parent body, which is likely to take place about a month hence. If the Trustees then approve of the plans and decide to go ahead with a scheme, a Provisional Order will be promoted. At the Chamber of Commerce meeting referred to, it was made quite clear that Government aid in constructing the dock would not be forthcoming. Liverpool has decided to build a "Dreadnought" dock without Government assistance, and the president of the Chamber stated that it was quite certain the Clyde would have to follow the Mersey's lead if it was to keep its place as a shipbuilding centre for Government "Dreadnoughts." The proposed scheme for utilizing the Clyde Trust ground at Renfrew provides for the construction not only of a graving dock of the largest dimensions, but also of a large tidal basin and wharves and warehouses and up-to-date loading and unloading facilities.

Messrs. Barclay, Curle & Co., Ltd., Whiteinch, on July 7th, launched the twin-screw steamer *Rursk* of 10,000 tons, built to the order of a London firm for Russian owners. She is designed for passenger and emigration trade, and has been constructed to Lloyd's highest class. The berth vacated by the *Rursk* is now being occupied by a steamer for the British India Steam Navigation Co., and Messrs. Barclay, Curle & Co. are in the unique position of having all their large berths occupied by work for the British India Steam Navigation Co.

Messrs. Yarrow & Co., Ltd., Scotstoun, have now put through her official full-speed trials the torpedo-boat destroyer *Sergipe*, the last of the ten destroyers ordered by the Brazilian Government. The contract speed of 27 knots —the vessel carrying a load of 100 tons—was easily exceeded ; the speed obtained being 27·676 knots on the measured mile, and 27·605 knots during a continuous run of three hours. The first seven vessels are now in commission in Brazil, the eighth and the ninth, after being handed over to the Brazilian authorities, left the Clyde on July 6th. The dimensions of the Brazilian destroyers are :—Length, 240 ft. and beam 23 ft. 6 in. Each vessel is propelled by two sets of four-cylinder reciprocating engines of 8000 horse power collectively balanced on the Yarrow, Schlick and Tweedy system. Steam is supplied by two double-ended Yarrow boilers of the latest type.

Messrs. John Brown & Co., Ltd., Clydebank, have now to their credit on the Harwich-Hook of Holland service of the Great Eastern Railway Co. three turbine-propelled steamers. These are the *Munich*, the *Copenhagen* and the *St. Petersburg*, the latter having been put on her station so recently as the beginning of July. The propelling machinery of the vessel consists of Parsons marine type steam turbines driving triple screws. Like all the boats in this service, the *St. Petersburg* is fitted with apparatus for wireless telegraphy and submarine signalling. Although swift, short passage vessels, they have accommodation for first-class passengers similar to that provided on a modern Atlantic liner.

Glasgow Branch of Navy League.—A meeting was held in Glasgow on June 23rd to establish a branch of the Navy League in the city. The Earl of Glasgow presided, and amongst those present were Sir Matthew Arthur, Bart., Mr. Paul Rattenberg, LL.D., Mr. Arthur Kay, Col. Jas. Smith Park, M.V.O., Col. R. E. Aitken, and Mr. Henry Andrews, secretary for the branches. Mr. Henry Andrews, in the course of a brief address, said that the objects of the League were, firstly, the education of the people as to naval affairs, and secondly, the practical training of lads for sea. Col. J. Smith Park moved that they approve of the establishment of a branch of the Navy League in Glasgow, to be called the Glasgow and West of Scotland Branch. He said his chief reason for supporting the Navy League was not so much that it afforded opportunities for the training of lads for the sea, but because both parties in the state had, time and again, shown a disposition to neglect the interests of the nation in regard to the Navy. It was necessary to have such a body as that to educate public opinion, and to put pressure upon the Government. Mr. B. E. Findlay seconded, and the motion was adopted.

The Caledon Shipbuilding and Engineering Co., Ltd., Dundee, have received an order from the Straits Steamship Co., Singapore, to build a steamer for their passenger and cargo trade. The new vessel, which will be the fifth built by the Caledon Company for the same firm, will measure 280 ft. long and 37 ft. broad, with a moulded depth of about 17 ft. It will steam 15½ knots. The Caledon Company, early in July, received an order from Messrs. Langlands & Sons, Glasgow and Liverpool, for a steamer 300 ft. long, with a beam of 48 ft. and a depth of 17 ft. The steamer will be built on fine lines and will develop a speed of from 12 to 13 knots.

Dock Improvement at Leith and Dundee.—The Leith Dock Commissioners have accepted offers by the National Gas Engine Company for the supply of plant necessary for the extension of the electric system in the docks. The contract includes two sets of engines and dynamos and three gas plants. The proposed construction of a harbour between Leith and Newhaven was considered at a meeting of Leith Dock Commission on July 8th. It was agreed in the meantime that soundings should be taken with the view of ascertaining where the breakwater should be built.

It has been remitted to the engineer of the Dundee Harbour to report to the Harbour Trustees on the question of providing improved facilities for the repair of ships. Lord Provost Urquhart has been repeatedly interviewed by shipbuilders stating that the equipment in the way of cranes at the graving dock was antiquated and travelling cranes should be provided.

TYNESIDE AND WEARSIDE.

(From our own Correspondent.)

Tyneside.

The Naval Base Scheme.—The most prominent matter exercising the minds of Tyneside shipping circles during the past month has been the question of making the Tyne an adequate naval repair base. A most prominent and influential deputation, including Sir William Stephenson, Mr. Herbert Shaw and other delegates representing municipalities and chambers of commerce on the North-East Coast, waited on Mr. McKenna and urged the claims of the port, but was met with a most uncompromising refusal. It is now fairly evident that no further hope of action may at present be expected, it being the official opinion that the Jarrow Slake is unsuitable. The next stage of the matter was the suggestion that Messrs. Stephenson's dock at Hebburn should be made use of by the Admiralty, as it is already used for docking "Dreadnought"-type vessels by Messrs. Armstrong, Whitworth. A question on the subject asked in Parliament has, however, elicited the information that while it is suitable for such vessels when they are carrying the coal and stores necessary for trial trips, it would be necessary to unload a full sea-going cargo of stores and coal in order to get into the dock. The Admiralty point of view appears to be that the floating docks already apportioned to the East Coast are sufficient.

Messrs. Palmers' Shipbuilding and Iron Co., Ltd.—It is reported that Messrs. Palmers are at present having a flourishing time in the way of booking orders. One of the latest is a cargo vessel of large dimensions for the Ellerman Lines, Ltd. A glance at the yards from the river reveals a very pleasant scene of activity. Progress is being made with the *Hercules*, while among other vessels on the ways are a ship building for the British India Steam Navigation Co., and other vessels for the mercantile marine.

Messrs. W. G. Armstrong, Whitworth & Co., Ltd.—The firm of Messrs. Armstrong, Whitworth have every reason to be proud of their latest vessel for the British Admiralty, the *Newcastle*, whose performance is in keeping with their best traditions, both in the gunnery trials and speed trials. In the latter a speed of 26·26 knots was obtained. The Lord Mayor of Newcastle is presenting the officers' mess with a service of plate, and Tyneside people will watch the progress of this vessel with especial interest. It is now reported that the firm has received an order from the Brazilian Government

for a vessel of 32,000 tons displacement, with a primary armament of twelve 14-inch guns and a secondary armament of twenty-eight 6-inch and 4-inch guns. It will be seen by this announcement, made by the Newcastle *Daily Chronicle*, that the new vessel will exceed in size and power any war vessel which is at present floating or being built.

Messrs. Swan Hunter & Wigham Richardson, Ltd.—This firm has received an order from the Cunard Co. to build another liner, to be named the *Laconia*, and to be a sister ship to the *Franconia*, which was launched on the 23rd July. This will further supplement the large amount of work this firm has in hand at present.

Ship Breaking.—The *North Mail* reports the interesting item that an historic British battleship, the *Barfleur*, has been bought by Messrs. Hughes & Bolckow, of Blaydon-on-Tyne, for breaking-up purposes, and the vessel will shortly finish her last voyage in the upper reaches of the Tyne.

Repair Work.—It is also reported that during the present month there is a large amount of work going on in Messrs. Smith's dock in connection with the repair of oil-tank steamers in the way of periodic overhaul.

The Tyne Training Ship.—The *Wellesley*, located in the Tyne, has now a new captain-superintendent in the person of Lieut. Percy de Winton Kitcat, who succeeds Capt. Henry Baynham, who recently resigned.

Wearside.

General.—The returns for the Wear shipbuilding show a favourable return to activity. It is reported that last month six vessels of 15,893 tons were launched from Sunderland, as compared with a tonnage of 14,395 in the corresponding month of last year. In the first six months of the present year thirty-six vessels, aggregating 97,403 tons, have been launched on the Wear.

River Wear Commissioners.—The Traffic Committee of the River Wear Commissioners evidently anticipate a further increase of business in the near future, as they passed a recommendation this month that an amount of new machinery in connection with the dock equipment should be ordered. On the 7th of July the annual survey of the river and docks was held by the Commissioners.

Messrs. R. Ropner & Sons.—At the shipyard of Messrs. R. Ropner & Sons, of Stockton, there has been a slight labour disturbance, some riveters and boys, to the number of about 100, coming out on strike as a mark of disapproval of the test put on their work. This step was, it is understood, taken before terms of settlement had even been discussed, and therefore an infringement was made of the agreement between the Employers' Federation and the Boilermakers' Society.

The Tyne-Tees Shipping Co.—The latest vessel of the Tyne-Tees Shipping Co., the *Stephen Furness*, is giving great satisfaction, being described as a "picture of floating comfort." She has made her first voyages in a very first-class manner, showing herself to be a very seaworthy vessel.

THE TEES AND HARTLEPOOLS.

(From our Own Correspondent.)

Middlesbrough.

The outlook in the district is not encouraging; the enquiries that are in the market are all for steamers for special trades, very few enquiries are for tramp steamers.

Messrs. Sir Raylton Dixon & Co., Ltd., Cleveland Dockyard, expect shortly to launch the first of the two iron ore boats building to Messrs. W. Esplen & Son's specification. Besides considerable work on hand they have secured the contract to build two steamers for the Atlantic Sea Navigation Co., Ltd., of Budapest, and altogether may be said to be fairly busy.

Messrs. W. Harkess & Co. are busy with work on hand, and were reported to have secured an order for a small coasting steamer, but the report lacks confirmation.

Messrs. Smith's Dry Dock Co., South Bank, are reported to have booked an order from a Bristol Channel firm for three small coasting steamers of about 150 ft. long; they keep very busy in the dry dock and repair departments.

Messrs. Richardsons, Westgarth & Co. are reported to have secured the contract to supply the engines and boilers for two steamers to be built locally. This firm have just been placed on the Admiralty list for their now well-known "Nestdrum" water-tube boiler, which has made rapid headway for land work. They are also fairly busy in their speciality departments.

Stockton and Thornaby.

Messrs. Craig, Taylor & Co. keep fairly busy. They recently launched a finely modelled steamer of about 700 tons deadweight for Messrs. Joseph Hoult & Co., Ltd., Liverpool, christened the s.s. *Benpark*, which is now being fitted out.

Messrs. R. Ropner & Sons are fairly busy. They are reported to have secured a contract to build a medium-sized steamer for foreign owners.

Messrs. Richardson, Duck & Co.—Nothing new is reported during the month. They are fairly busy with work on hand and expect to secure a contract which is in the market, but bidding is very keen and prices low.

On the Tees there are building about thirty-four steamers of about 71,000 tons, which is much below the average.

Messrs. Blair & Co. are reported to have secured the order to supply two sets of engines and boilers for steamers to be built on the Tees.

West Hartlepool.

Messrs. Furness, Withy & Co. lately acquired the s.s. *Lowther Range*, which recently effected the salvage of the s.s. *Trieste* after a towage of seven days, reflecting great credit on the master, Captain Matthews, and crew.

Messrs. W. Gray & Co. maintain a large amount of work. They recently launched the s.s. *Registan* for Messrs. F. C. Strick & Co., Ltd., London, her machinery having the "Contraflo" system fitted to the condenser. They are very busy with the repairs to the s.s. *Hermiston*, which stranded on the Yorkshire coast; the damage is very extensive and will involve an expenditure of about £10,000.

The Central Marine Engine Works of Messrs. W. Gray and Co. are kept very busy; they are reported to be trying to engine and boiler one steamer per week, which indicates the vast amount of work they have on hand.

Messrs. Irvine's Shipbuilding and Dry Dock Co., Harbour Yard.—This yard has made a name for excellent work. The s.s. *Stephen Furness*, recently built by this firm, made 16·2 knots on the measured mile in loaded trim, being nearly 2 knots in excess of the guaranteed service speed. They are very busy and have started on another small steamer, all berths being occupied.

Hartlepool.

Messrs. Richardsons, Westgarth & Co. have been very busy fitting in the machinery of the s.s. *Indrabarah* at Wallsend at Messrs. Swan & Hunter's yard. They are very busy with work on hand, especially in their speciality departments, as they are putting on the market an accumulator for such land engines as run intermittently.

Messrs. Irvine's Shipbuilding and Dry Dock Co., Middleton, are preparing to launch the first of the three "Transport" liners for Messrs. Houlder Bros. Besides the work on hand they are reported to have secured a contract for a medium-sized steamer for delivery about December.

Messrs. R. Jobson & Co., Middleton Repair Works, have sold the s.s. *Garth* to foreign owners, who have re-christened her the s.s. *Tormod*.

On account of the N.-E.R. Co.'s strike of railwaymen trade is locally disorganized, and nearly all local works will be closed.

THE HUMBER AND DISTRICT.

(From our Own Correspondent.)

Messrs. Cooper & Co., engineers and boilermakers, have been very busy at their Neptune Engine Works with repair work for several large steamers, and completing work too large for their branch shops at Alexandra Dock. They have also a great number of propellers to cast for home and foreign orders, and their two dry docks, situated on the river Hull,

have been well booked for the past month and are well forward for August.

Messrs. The Hull Central Dry Dock and Engineering Co., Ltd., are still keeping very busy, with their own dry dock, and are often using the H. & B. Ry. Co.'s and the N.E.Ry. Co.'s dry docks. In the central dry dock is the s.s. *Olympic*, of Hull, undergoing extensive repairs to her bottom, and many other repairs, including engine-room and deck. She has been on the rocks in the Baltic. The following vessels have also been in dock :—s.s. *Canada Cape*, dry docked, etc. ; s.s. *Majestic*, of Hull, engine-room and deck repairs and several new frames ; s.s. *Hillglue*, s.s. *Rustington* ; s.s. *Ethyl*, of Hull, now in Alexandra Dock ; s.s. *Swallow*, engine-room and deck repairs, and bottom sighted (now sold to foreigners) ; s.s. *Hillmere*, usual engine-room and deck repairs.

Wilson Line.—The R.M.S.'s *Ariosto* and *Montebello*, each having carried the Mails, and thousands of passengers to Norway and Sweden, have now been sold out of the Wilson Line to Spanish owners, and will run between Valencia in Spain and Algiers in Africa. No doubt the Wilson Line will have to replace them with more modern steamers. We are now looking out for the new orders.

North-East Coast Engineering Works are to be congratulated in their success, having been exceedingly busy with repair and dry dock work. They have had the following steamers undergoing repairs :—s.s. *Polarstjernen*, s.s. *Callisto*, s.s. *Skerne*, s.s. *Arla*, s.s. *Ambassador*, s.s. *Ragnar*, s.s. *Cragronald*, s.s. *Canada Cape*, Elder Dempster liner, s.s. *Moorish Prince*, Prince liner of Newcastle. The last two mentioned steamers have undergone extensive repairs to deck and engine-room.

Messrs. Amos & Smith, engineers and boilermakers, have booked several sets of engines and boilers for Grimsby and Hull owners, and have received several orders for their patent steam-steering gears from home and foreign houses. Their shop at Alexandra Dock has been kept fairly busy with repair work, dry-docking, etc., and they have the dry docks secured for future dates.

Messrs. Earles' Shipbuilding and Engineering Co., Ltd., have just completed repairs on the s.s. *Chelmsford*, late owners Great Eastern Railway Co. She is now owned by the Great Western Railway Co., and has been renamed *Bretonne*, and will run in their Channel trade. The firm has slipped several other steamers on their patent slips, besides dry-docking others. They are also pushing forward for completion the two new steamers for the Continent trades for Great Central Railway Co., North-Eastern Railway Co., and Wilson's. Special attention has been paid to the carrying of perishable goods. We hear this Company has enquiries for building new steamers for local owners and has every prospect of securing the orders.

Hull's Revived Shipyard.—The Tilbury Dredging and Engineering Company and the Humber Warehousing and Transport Company have now (says the " Shipping Gazette ") finally completed the purchase of Messrs. Bailey & Leetham's old shipyard, known as the Humber Iron Works, a site of about ten acres (containing patent slip, fitting, boiler and smith's shops), at the mouth of the river Hull. The purchase includes the yard of the late firm of Messrs. Samuelson and Moss, who have built some fine sailing ships (clippers) and steamships. The yard has lately been in the hands of the well-known firm of Messrs. Cook, Welton & Gemmel, shipbuilders, mostly interested in the building of steam trawlers, who have recently removed to Beverley.

Messrs. Cochrane & Sons, shipbuilders, Selby, have just launched a large trawler for Grimsby, and are completing others for Hull and Grimsby owners.

Thomas Tate, engineer and boilermaker, has been very busy with repairs to engine-room and deck on several steamers berthed in the old harbour and town docks.

Messrs. Woodall & Co., engineers and boilermakers, are fully employed, and have, during the past month, been entrusted with a large number of repairs to deck and engine-room on steamers visiting this port. Part of their plant being chain-testing machines, they have been regularly employed in testing steering-gear chains, also winch loading gear. They are well booked up with orders for their Handebloc and heavy purchasing gear. The firm is decidedly progressive.

Messrs. G. Clark & Sons, coppersmiths, brass moulders, etc. This very old-established firm goes back to 1859, when they first started business in Waterhouse Lane. They have now grown into the largest business in the north of England, doing work for all nations of the world. The founder of the firm passed away a number of years ago, but the business is ably carried on by the son, Charles Clark. They recently cast two lead cylinders 7 ft. 6 in. diameter, 4 ft. 6 in. high, 2½ in. thick, a lead covering dome 7 ft. 6 in., with a height at the apex of 4 ft. 6 in., and a bottom plate of the same metal 7 ft. 6 in. diameter and about 6 in. high overall. The cylinders have elaborate connections, and the making has taken considerable time, great care being employed in making the casting exactly. When the sections are put together the result is a lead-domed cylinder about 14 ft. high, with a weight of nearly twenty tons. The cylinders are to be used in connection with the manufacture of chemicals, and this is the second order of its kind that Messrs. Clark have carried out recently.

Hull Docks Busy.—The Hull docks just now present a scene of great activity. In the Alexandra dock, there are several very large steamers, including s.s. *Knight of the Thistle* from Calcutta, and *Knight Errant*, with over 12,000 tons soya beans from the Far East, and other steamers from Bombay and South America, discharging grain cargoes. Victoria dock is busy with timber ships, and the other docks are busy, consequently employment is good. It is interesting to note that one firm alone, Messrs. Brown & Atkinson, steamship owners and brokers, have no fewer than eighteen steamers consigned to them with a tonnage of 40,000 in the Hull docks.

Coal Trade of Hull.—Never before in the first six months of any year has such a total tonnage been sent to Hull as 3,298,880 tons, and never in any previous month of June in the history of Hull has such a quantity been received as 627,376 tons. Both for the month and half-year all previous records are beaten. The Collieries sending over 100,000 tons each during the past half-year were :—Denaby Main, 508,536 tons ; Manvers Main, 181,232 tons ; Carlton Main, 144,896 tons ; Glass Houghton, 129,228 tons ; Brodsworth, 107,400 tons ; Hickleton, 106,048 tons ; Thorncliffe, 100,648 tons. The explanation is probably the demand for fuel abroad, the development of several new collieries, and the provision of various up-to-date shipping appliances at the respective docks. The utmost despatch is exercised in the loading of the numerous cargoes, thus making Hull known far and wide as an up-to-date port for the exportation of coal. The total tonnage received in the first six months of previous years were as follows :—1909, 2,706,064 tons ; 1908, 2,936,464 tons ; 1907, 2,913,648 tons ; 1906, 2,319,808 tons ; 1905, 1,759,536 tons ; 1904, 1,640,736 tons ; 1903, 1,628,704 tons ; 1902, 1,526,336 tons ; 1901, 1,461,568 tons. The foreign exports for the month, and for the half-year also, beat previous records, the increase for the six months being 387,683 tons, when compared with the corresponding period of 1909. During the first six months of previous years the exports abroad were as follows :—1909, 1,354,816 tons ; 1908, 1,250,243 tons ; 1907, 1,341,665 tons ; 1906, 1,079,323 tons ; 1905, 708,222 tons ; 1904, 663,325 tons ; 1903, 721,073 tons ; 1902, 626,649 tons ; 1901, 550,760 tons. The following countries were our largest buyers during the past six months, and taking increased supplies :—Russia, N., 317,676 tons ; Germany, 296,851 tons ; Holland, 281,127 tons ; Sweden, 179,711 tons ; Italy, 138,011 tons ; America, South, 131,814 tons. The coastwise exports reached 479,512 tons for the six months, against 497,541 tons in 1909, being a decrease of 18,029 tons. Out of the total exported, London alone took 319,256 tons.

SOUTH OF ENGLAND AND ISLE OF WIGHT.

(*From our Own Correspondent.*)

Messrs. J. I. Thornycroft & Co., Ltd., Woolston Works.—H.M.S. *Savage*.—The machinery of this destroyer was opened up for survey last month, and she will shortly be handed over to the Admiralty. The work on H.M. ships *Larne*, *Lyra*, *Martin* and *Minstrel* has made good progress. The turbines for the *Larne* were placed on board last month, and it is expected that she will be launched about the end of this month. The new fire float for the London Fire Brigade is to be named

the *Gamma*. The plating was completed last month. The hull of the 80 ft. stern wheel sawmill steamer for service on the Amazon is making rapid progress and the riveting was completed last month. The keel for the new shallow draught paddle passenger steamer *Arabia* is laid, and work is rapidly proceeding on this vessel. She is to the order of Messrs. Thos. Cook & Son, Ltd. The moulding loft were busy last month with the motor tank barge for the British Petroleum Oil Co. She is to be named the *Rocklight of London*. During July an order was booked for a 60 ft. twin-screw river steamer for the Brazilian Northern Railway Co. The firm have also booked an order as sub-contractors to Messrs. Camper and Nicholsons, Ltd., for the construction of the hull and machinery of a twin-screw yacht of 211 ft. length B.P. The firm, it will be remembered, built the large 202 ft. yacht *Miranda* for Lord Leith in the same way.

Repair Work.—H.M.S. *Halcyon*. The extensive repairs to this vessel have been satisfactorily completed, and the vessel handed over to the dockyard authorities. Other vessels in hand during last month were the s.ys. *Rainbow*, *Fawette*, *Miranda*, s.s. *Alnwick Castle*, *Okahandja* and *Lowgarth* and the sailing ship *Sophie*. Repairs to the lattice bridges of H.M.S. *Vernon* are also in progress.

Messrs. J. Samuel White & Co., Ltd., East Cowes, I. of W., successfully launched H.M.S. *Redpole* on the 24th June last, and work is progressing rapidly. H.M.S. *Basilisk*, ocean-going destroyer, ran her official full power trial on the Skelmorlie mile on the 8th of last month with most satisfactory results. She attained a considerable margin of speed over the contract stipulation for 27 knots.

Messrs. Day, Summers & Co., Ltd., Northam.—The steam yacht *Lady Evelyn* has left the yard after considerable structural alterations to hull and machinery, and engaged in an important series of trials. The steam yacht *Honor* was lying off the yard last month, being painted after dry docking. Several important alterations have been carried out on the s.y. *Albion* with very successful results. The steam yacht *Medusa* is at the yard refitting for an extended cruise. The s.s. *Don Carlos*, built for the Liebig's Company, ran her trials last month. The 100-ton sheers for Aberdeen are completed, and the bulk of the machinery has been sent North. H.M. tug *Grappler* was hauled up last month for considerable overhaul, and the Government vessel *Elizabeth* is expected shortly and will have a new boiler fitted. The s.s. *Bittern* was docked and put through survey and a considerable amount of repair work carried out. The patent coaling craft designed by the firm has been taken over after successful trials, and is now at work in the port. The firm are also engaged fitting out the s.s. *Alnwick Castle* for the forthcoming manœuvres.

Messrs. Simpson, Strickland & Co., Ltd., Dartmouth, have a large amount of work in hand for the British and foreign Governments. Boats in hand or on order embrace a 50-ft. steam pinnace for the Admiralty and a 26-ft. steam launch to be fitted with Kingdon quadruple engines, and a Kingdon vertical boiler for the Belgian Government; a 43-ft. double skin teak launch to be fitted with triple engines, and a water-tube boiler for the India Office. Four boats for the Brazilian Government have just been completed, comprising a 34-ft. steam cutter, a 34-ft. sailing cutter and two 30-ft. open cutters. A large amount of repair work and alterations have recently been carried out. A set of auxiliary steam machinery has been fitted to the ketch yacht *Brown Mouse*. This boat is built on the lines of the large Brixham trawling ketches, and the new machinery has proved very satisfactory. The cutter *Merlin* has been fitted with a motor for auxiliary purposes.

THAMES.

(*From our Own Correspondent.*)

Port of London Bill.—The Select Committee of the House of Commons, presided over by Sir Luke White, has concluded the consideration of this bill, which enables dues to be levied by the Port Authority with the proviso that an unfair proportion of the port rates was not to be thrown upon the river trade, having regard to the circumstances of the port at the time. One of the exemptions from dues is fish, which, if caught in the open sea and brought in fresh, is to come free. As the matter stood at the beginning of this enquiry Lord St. Aldwyn had already reduced the possible gross return of rates from £756,000 to £484,000, and the Authority asked to have a free hand in granting any more reduction. The Midland manufacturers have a grievance that no charges are to be imposed on goods entering the port for transhipment, whereas the inland traffic has to pay. This matter will be further discussed in Committee on its merits, the case of the waterside manufacturers being left to the Authority to decide. The matter stands postponed.

Shipping Companies.—The Royal Mail Co. has held a meeting to authorize the raising of £600,000, one-half in preference shares and the other half ordinary, with the object of acquiring the Pacific Co.'s shares as par value. The Royal Mail at time of purchase is valued at £3,320,088 and the Pacific Co. at about £1,450,000. The purchase has met with the approbation of both Companies. The amalgamation will be seen to be a most important one. Another deal that seems nearing an issue is the proposed acquirement by Sir John Ellerman of a controlling interest in the Shaw-Savill Co.'s line. This Company's boats are twelve in number, including one building, the largest running being the *Tainui* of 6288 tons. If the matter is carried through there will then be 500,000 tons of shipping under the one control. The price offered is £15 a share with an addition of 5 per cent. a share in the event of the owners of more than 15,000 shares agreeing to sell. The P. & O. Co. is again active, having two liners being built for its Australian trade and the largest under its flag, named the *Maloja* and *Medina*. They will be of 125,000 tons gross and each 550 ft. in length, with a breadth of 62 ft. 6 in. They are to be twin-screw vessels propelled by quadruple-expansion engines of 15,000 h.p. Another project of this Company is that of three intermediate boats for the Lund Line to Australia *via* the Cape. One is in construction already at Glasgow, and tenders for the other two are issued.

Warship Engines.—It is understood that the Thames Iron Works Shipbuilding and Engineering Co. are to supply a set of engines for a second-class cruiser in course of construction at Chatham, and if this is the case the machinery will be constructed at Greenwich in due course. The matter will be welcome to all concerned, and especially to a large body of workers on the south side of the river.

Training Ships.—The London Cadet Ships, *Port Jackson* and *Medway*, have received the support of the White Star and Booth lines, these companies having decided to interest themselves in the company formed under the management of Messrs. Devitt and Moore, to take over these vessels and who will take their officers from the cadets so trained. This decision makes five large companies who are directly interested in this project. The *Medway* leaves London with a general cargo early in August for Sydney and the *Port Jackson* follows for the same destination in September. The training ship *Warspite*, lying at Greenhithe, was inspected by a representative party of visitors, at the head of which was Mr. W. Foot Mitchell, M.P. for Dartford. It appeared there is still room on the vessel for 250 more boys, but funds were not forthcoming for the purpose of filling the vacancies.

Royal Observatory, Greenwich.—The annual visitation took place recently, the Board of Visitors holding its annual meeting in the Hall of Flamsted House at the Observatory. An inspection of the instruments was made and the report of the Astronomer Royal read, a special tribute being paid to the staff. The Board comprises the most distinguished men of science in this branch.

MERSEY AND MANCHESTER SHIP CANAL.

(*From our Own Correspondent.*)

In these days of keen competition amongst the large seaports of Great Britain, and when reports are current of improvements in hand and contemplated at Glasgow, Southampton, Fishguard, etc., it is noted with satisfaction that Liverpool is keenly alive to maintaining its position. Large additions are contemplated to the Liverpool Docks, also improvements to the Birkenhead Docks, revision of the pilotage service, provision of a motor pilot boarding punt, etc. New work is not so plentiful this month, but it is expected that orders may be looked for in the near future, both for Admiralty and merchant work.

Messrs. Cammell, Laird & Co.—Work on the four destroyers for the Argentine Government is proceeding rapidly, the first vessel having her plating finished, while the others are in various stages of framing, etc. The *Renard*, *Wolverine* and *Racoon* have all passed through successful speed and consumption trials and will shortly be commissioned. Work is being pushed rapidly forward upon the two destroyers for the British government, orders for which were recently received. The *Blonde's* machinery is well in hand, the auxiliary machinery being already on board ready for the launch, which takes place at the end of July, at Pembroke. The large Floating Dock, with its special machinery, is well in hand. The Wallasey Ferry Steamer *Bluebell* was launched on June 23rd, being named by Miss Joyce, sister of the chairman of the District Council of Wallasey. The machinery is all in place and the vessel is having her finishing touches prior to going on trial. Her sister vessel, the *Snowdrop*, is ready for launch, both vessels will thus be on service early in August. The *Cæsarea*, the first of the fast turbine steamers for the London & South-Western Railway Co., is completed, and is awaiting her trials, while the *Sarnia*, the sister ship, was launched on July 9th, the naming ceremony being performed by Mrs. H. Rollitt. These vessels are built to Lloyd's and Board of Trade requirements, and are 284 feet long on water line, 39 feet broad and 16 feet 6 in. deep to main deck, and carry 186 first-class and 114 second-class passengers, with a crew of forty-eight. The *La Blanca*, a steamer 207 feet by 36 feet beam and 22 feet moulded depth, was recently launched for the Sociedad Anonima La Blanca of Buenos Ayres for carrying chilled meat from the upper reaches of the River Plate to the seaboard. The second steamer for the Nelson Line was launched on the 26th July, the other steamers for the same owners being well advanced. The tug *Hercules* is completed and has finished trials, and will shortly be handed over. An order has been booked for an emigrant boat for the Indian coolie trade, about 360 feet long. The Meat Barge for the Swift Company has left for the River Plate. The repair department has been kept well employed. The Johnston liner *Quernmore* is having deck damage repaired, this having been caused by heavy seas. The *Queensland* is undergoing survey and is having grounding damage repaired. The tugs *Hotspur* and *Heathcock* have had extensive repairs.

Messrs. H. & C. Grayson.—The various yards of this firm have been busy with their usual overhaul and repair work. The steamer *Nancy Lee* has been in the Langton Dock for general repairs and overhaul. The repairs to the Elder Dempster steamer *Batanga* are now complete. Two new types of tenders for use in connection with the C.P.R. and Allan Line steamers are being built for the Mersey Towing Co. The steamer *New Orleans* has had extensive survey work, while in the Birkenhead yard the steamers *Ottar* and *Linda Fell* are undergoing repairs. Some of the pontoons for abroad are ready for shipment, while the others are nearing completion.

Messrs. Clover, Clayton & Co.—This firm have been kept busy with general repair and surveys. The Langlands' Line steamer *Beatrice*, which recently grounded off the west coast of Scotland, is in hand for repairs to bottom. The *Largiemore*, which recently had extensive repairs done, has now been sold and is in for painting and sundry repairs.

Messrs. Henry Wilson & Co., Ltd.—This firm have in hand, and will manufacture at their Cornhill Works, the galley outfits for their new White Star steamers *Olympic* and *Titanic*. These comprise, besides the usual cooking ranges, which, we may say, in this case are probably the largest of their kind, their electrically driven patent roasters, dough mixing machines, potato peelers, steam ovens, etc., as well as hot presses and other fittings for the pantries. Messrs. Wilson have already fitted out most of the recent large liners, including those of the Cunard, P. & O., Royal Mail, Allan, New Zealand Steamship Co., etc.

Messrs. The Kermode Liquid Fuel Co.—It seems certain that a great field lies before engineers in general with regard to oil as a fuel. Mr. T. T. Kermode has been associated for many years with the special applications of oil fuel for the raising of steam for practically all purposes, chiefly, however, with regard to marine propulsion. The present use of oil as a fuel in the British navy being due to his experiments, beginning with H.M.S. *Surly*. This system has been put into use for fire engines, road-tractors, on tea plantations, glass works, etc., not to speak of its rapidly increasing use at sea. A vessel of 92 feet long has recently been built at Java, and fitted with water tube boilers to burn crude petroleum, the steam used for heating, etc., the oil being afterwards condensed. This system, it is claimed, uses from 70 to 75 per cent. of the calorific value of the fuel. With the ever increasing oil fields, the placing on the market in the near future of crude oils at low cost, will bring this subject to the front. Successful tests have recently been carried out at Annan of a battery of Cochran boilers fitted with the Kermode System of oil fuel, and are now being shipped to Patagonia to the order of the Argentine Government.

Mersey Docks and Harbour Board.—The Dock Board returns for the past year give the Mersey tonnage at 33,308,142 tons, as against 33,494,958 tons for 1909. The Board will commence work at once on the construction of an immense Dock at the North end, which it is understood will form part of an extensive scheme. It is expected to be the largest dock in the world, and will accommodate vessels over 1,000 feet long and of over 60,000 tonnage. It is hoped that the dock will be completed in three years, and as this corporation is possessed of all the requisite plant and machinery, it is expected that the work will be done by themselves. In view of the proposed new Cunarders of 50,000 tons, this activity of the Dock Board will give general satisfaction.

The Mersey Pilotage Service.—An inquiry has been recently held in London into the proposed alterations to this service. It is proposed that the appropriated pilot should await an expected steamer in the pilot boat off Point Synas and bring her into port, formerly the picked pilot only taking the ship outwards. Shipowners approve the alterations, while the pilots seemingly oppose it.

Manchester Ship Canal.—The report of work done upon the works of the Canal for the year show that from the tidal portion 387,132 tons of material have been dredged, while the grand total given, 1,569,445 tons. But for the existence of the Canal most of this material would have found its way into the Mersey. Ninety-one wrecks and casualties were dealt with, eleven vessels being raised by the Dock Board, the rest by the owners.

Cunard Line.—The *Sylvania*, now lying in Messrs. Cammell, Laird's wet dock, has been sold to Italians for breaking up. It has been decided to call the new boat ordered from Messrs. Swan & Hunter the *Laconia*, after part of South-east Greece. Her sister ship, the *Franconia*, was launched on 23rd of July.

Pacific Steam Navigation Co.—This company's steamer *Luca*, which went ashore near the Isle of Bute, has been refloated and gone into dry dock on the Clyde. The *Sarmiento* has been sold to a French firm. This vessel was 361 feet by 43 ft. 2 in. by 19 ft. 6 in., was built by Messrs. Harland & Wolff in 1893, and has been continuously in the South American trade.

Messrs. John Holt & Co.—Messrs. William Hamilton and Co., of Port Glasgow, have recently built for this firm a mosquito-proof steamer, the *Johnathan Holt*. This vessel is fitted with ordinary doors and portholes and also duplicate doors and portholes of close mesh copper gauze. This system has been found to yield great protection to the crew in tropical climates. A similar vessel is on order.

NORTH-WEST OF ENGLAND.

(*From our Own Correspondent.*)

Messrs. Vickers' Achievements.—Messrs. Vickers' firm at Barrow have, during the past month or so, been making their mark once more in the shipbuilding and engineering world. Following upon the successful trials of the Brazilian battleship *Sao Paulo*, came the remarkable trials of the *Liverpool*, which is of the "Town" class. There was not a single hitch in connection with this vessel's tests; although she is not the first vessel of this class to be completed she is the first to pass through her trials. The contract speed at full power was 25 knots. Messrs. Vickers with the *Liverpool* got a knot and a half more. This vessel proved herself to be a fine sea boat, her gear tests were passed through successfully and the vessel was back in Barrow in no time. One lesson appears to have been learned from the trials; the four

funnels were taken out and have since had 6 ft. added to them. This should mean a great improvement. The *Liverpool* was sixteen months building from keel to trials.

The huge floating dock built at Barrow to the order of the Brazilian Government was launched in three sections on July 7th, 8th and 9th respectively. Afterwards they were joined up at Ramsden Dock and on July 4th left in charge of the two Dutch tugs, the *Zwartezee* and *Roodezee*, for Rio Janeiro. The piecing up of this structure was, owing to the correctness of construction, a most simple affair, in fact the whole contract, which stipulated that the dock had to be built and delivered within eleven months, has been most successfully fulfilled. Messrs. Vickers, of course, have no responsibility in connection with the towing of this Dreadnought floating dock out to Brazil, but if statement be true the cost of towage and putting the responsibility on Dutch shoulders totals some £16,000. It has been stated that this dock is the largest in the world. That is not so, for there are some completing in Germany capable of lifting to 17,000 tons more than the Brazilian, which is capable of dealing with 23,000 tons.

The "Princess Royal."—Considerable progress is being made with the construction of the battleship-cruiser *Princess Royal* at Messrs. Vickers' since the laying of the keel. A large number of men are engaged on the shell and day by day this 26,000-ton monster grows. In the foundry and engineering shops the staffs are becoming very busy on the 70,000 i.h.p. machinery, but of course the boilers and turbines for the sister ship the *Lion*, which is building at Devonport, and which will be launched about August, are taking priority. This contract undoubtedly establishes a record and if success continues to follow in the footsteps of Messrs. Vickers, and there seems no reason why it should not, in view of the magnificent organization at the Barrow works, it will be a remarkable thing to see them putting out two huge vessels in quick succession, each attaining close upon 30 knots speed.

A Destroyer Ordered.—In past years Messrs. Vickers, as the then Naval Construction and Armament Company, used to get a fair share of orders for destroyers, but for some time they have not built any of this class. Speeds were obtained in the past but it was worrying work, and there was perhaps very little margin left after the trials. Now since the advent of the turbine, and in view of the fact that Messrs. Vickers have made a speciality in the construction of this class of propelling machinery, they should be only favourably placed as regards obtaining the desired results. An order for a destroyer has been placed, and more than likely Messrs. Vickers are out for more experience and very likely more records. There is no Company in the world that has been so successful in obtaining speed from vessels they have constructed, both naval and otherwise, and it will not be surprising if Messrs. Vickers establish themselves as successful destroyer contractors.

Prospects.—At the moment there does not appear to be any work likely to be placed with Messrs. Vickers as far as outward signs are concerned, but there has been a considerable amount of quiet work going on and it would not be surprising to learn very soon that this great firm had put its foot on another step and had eventually secured a chance to distinguish itself in shipbuilding otherwise than Admiralty work and channel steamers. At the moment it would not be wise to say more, but I am given to understand that Messrs. Vickers are favourably placed and mean to get into another branch of shipbuilding—one in which, if they do get in, they will want a lot of putting out. They mean to make a name, and having once made it, they will stick to it. That has ever been their policy.

Submarines are still being constructed, and the district is also on the tiptoe of expectation regarding the big naval airship, which is expected out in a month or two. Messrs. Vickers are most strict in respect to the construction of this dirigible—all secrets are jealously guarded. Armed men patrol outside and inside the shed. A short time ago a man caught inside the barricading just outside the shed was taken before the local magistrates and sent to prison for two months. There has been less spying since, and amateur photographers are giving the shed a wide berth. Before that it was a regular meeting ground for them. This airship, when it does make its appearance, will cause some sensation. I have special reason for saying that it will be far ahead of anything in the dirigible line in the wide world.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES English.

Accrington.—On June 7th, Messrs. Earle's Shipbuilding and Engineering Co., Ltd., Hull, launched from their yard a handsomely modelled vessel built to the order of the Great Central Railway Co. for quick passenger and cargo service between the ports of Grimsby and Hamburg. The principal dimensions are :—Length, 265 ft. ; breadth, 36 ft. extreme ; depth, 18 ft. 6 in. moulded. The vessel is constructed of steel, and has been built under special survey to Lloyd's 100 A1 class, Board of Trade latest rules, and in accordance with the German Emigration Laws, and the Hamburg Harbour Authorities requirements. She is of one deck type with poop, long bridge, and topgallant forecastle. There is ample accommodation for first, second and third-class passengers. The saloons are arranged on main deck, that for first-class extending to the sides of vessel. The lavatory accommodation is extensive, and the ventilation of these compartments has received special consideration. The arrangement and fittings of galleys, pantries, etc., are thoroughly up-to-date, and include all the latest improvements. The vessel is provided with all necessary cargo gear for rapid loading and discharge, and will be fitted with a special type of steam, hand, and telemotor steering gear. A complete installation of steam heating, electric lighting, bells and telephones will be fitted. The machinery will consist of a set of triple-expansion surface condensing engines, having cylinders 22 in., 35 in., 60 in. by 42 in. stroke, indicating about 2000 i.h.p. Steam will be supplied by two large cylindrical boilers working at a steam pressure of 180 lbs. per square inch.

Steel Screw Trawler—On June 8th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 120 ft. by 21 ft. 6 in. by 12 ft. 3 in., moulded. The vessel has been built to the order of Messrs. The Great Central Co-operative Engineering and Ship Repairing Co., Ltd., of Grimsby, and will be fitted with powerful triple-expansion engines by them. She is replete with all the latest improvements for fishing purposes.

Oakmere.—On June 8th, there was launched from the yard of the Sunderland Shipbuilding Co., Ltd., the steel screw steamer *Oakmere*, her dimensions are—length between perpendiculars, 245 ft. ; breadth extreme, 36 ft., and 18 ft. 3 in. depth moulded, having complete shelter deck in addition and is built to Lloyd's highest class, under special survey, the vessel will carry 2200 tons deadweight, and is designed for a speed of 10½ knots loaded, water ballast in cellular bottom and peak is fitted. The steamer has been built to a very full specification, has a complete outfit for handling cargo, including five steam winches, double derricks to each hatch, together with steering gear, large donkey boiler and direct steam windlass. The engines are by the North-Eastern Marine Engineering Co., Ltd., Sunderland, and have cylinders 18½ in., 31 in., and 51 in. by 36 in. stroke, steam being supplied by a large boiler working at a pressure of 180 lbs. per square inch. The vessel has been built to the order of Messrs. The Watson Steamship Co., Ltd., of Manchester, for their Manchester and Mediterranean fruit trade.

Leucadai.—On June 8th, there was launched from the yard of the Tyne Iron Shipbuilding Co., Ltd., Willington Quay-on-Tyne, a steel screw steamer built to the order of the International Line Steamship Co., Ltd., of Whitby. It is interesting to note that this vessel is built on the Isherwood patent system of longitudinal framing and is the first vessel of this type to be launched on the Tyne, and marks a considerable advance in shipbuilding progress. The vessel is one of three of the same size and type which are building by the same company. The vessel is built to the highest class at Lloyd's and is of the following dimensions, *viz.* :—Length overall, about 360 ft. ; breadth extreme, 50 ft. ; depth moulded, 25 ft. 10 in. She is built under the single deck rule with poop, bridge and forecastle. Has water ballast fitted right fore and aft on the cellular system and is also fitted with all modern improvements for the rapid loading and discharging of cargo, including eight double cylindered steam winches, direct acting steam windlass, large multitubular donkey boiler, steam steering gear by

Messrs. Donkin & Co., with right and left-hand screw gear aft. She is fitted with double derricks to all main cargo holds and has derrick posts on bridge for dealing with the cross bunker hatch, and is in all respects an exceptionally good example of the modern cargo steamer as she carries about 6400 tons deadweight on the very light draught of 21½ ft. The engines, which are to be supplied by Messrs. John Dickinson & Sons, Ltd., of Sunderland, are of the triple-expansion type, having cylinders 24 in., 40 in. and 66 in. by 45 in. stroke with two boilers 16 ft. by 10 ft. 6 in., working at a pressure of 180 lbs.

Port Curtis.—On June 8th, Messrs. R. & W. Hawthorn, Leslie & Co., Ltd., launched a vessel from their Hebburn Shipyard. The dimensions of the *Port Curtis* are :—Length, 400 ft. ; breadth, 52 ft. 9 in. ; depth, 18 ft. 10½ in. ; and she will carry a deadweight of about 8100 tons. The propelling machinery, which has been built by the North-Eastern Marine Engineering Co., Ltd., consists of a set of quadruple-expansion engines, with cylinders 25½ in., 36 in., 52½ in. and 76 in. by 51 in. stroke, the steam being supplied by three large boilers, which will enable the vessel to steam at a speed of 12 knots. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel was applied to the surfaces in machinery space and boiler spaces, holds, etc., also in double bottom under boilers, etc.

Towneley.—On June 9th, Messrs. Wood, Skinner & Co., Ltd., of Bill Quay, Newcastle-on-Tyne, successfully launched from their shipbuilding yard a steel screw collier which they have built to the order of Messrs. The Burnett Steamship Co., Ltd., of Newcastle-on-Tyne. The steamer is in every way of the most up-to-date description and is of the long raised quarter deck type with long bridge and topgallant forecastle, having specially large self-trimming hatches and will be fitted with all the latest improvements and appliances especially in the way of deck machinery and gear to facilitate the discharging of coal cargoes with the utmost despatch. She has been constructed on a fine model with a view to obtaining a good speed and is provided with water ballast of large capacity in the cellular double bottom and fore and after peak tanks. The propelling machinery consists of a set of triple-expansion engines, supplied with steam by two large steel multitubular boilers, and which will be fitted by Messrs. The North-Eastern Marine Engineering Co., Ltd., of Wallsend-on-Tyne. Both the ship and engines have been built under the special survey of Lloyd's for their highest classification.

Tadorna.—On June 9th, there was launched from the Neptune Works, Newcastle-on-Tyne, of Messrs. Swan, Hunter & Wigham Richardson, Ltd., a fine screw steamer which is being built to the order of the Cork Steamship Co., Ltd., of Cork, for their service between Manchester, Liverpool and Dutch and Belgian ports. The steamer, named *Tadorna*, is built of steel, 275 ft. in length by 36 ft. beam, and intended to carry 2450 tons deadweight on a moderate draught of water. She has accommodation for a limited number of passengers. She will be propelled by triple-expansion engines, which with the boilers, two in number, are also being constructed by the builders at their Neptune Works. The vessel is similar to several vessels constructed by this Tyneside firm for the Cork Steamship Co., Ltd. Messrs. Cochran & Co. (Annan), Ltd., have supplied one of their Cochran (Annan) donkey boilers fitted with patent seamless furnace.

Boukadra.—On June 10th, Messrs. William Gray & Co., Ltd., launched the handsome steel screw steamer *Boukadra*, which they have built to the order of Messrs. Frank C. Strick and Co., Ltd., of London and Swansea, for La Tunisienne Steam Navigation Co., of Paris. She will take the highest class in Lloyd's and is of the following dimensions, *viz.* :—Length overall, 362 ft.; breadth, 50 ft., and depth, 25 ft. 11½ in., with long bridge, poop and topgallant forecastle. The hull is built with deep bulb-angle frames, cellular double bottom and large aft peak ballast tank, ten steam winches, steam steering gear amidships, hand screw gear aft, patent direct steam windlass, large horizontal multitubular donkey boiler, stockless anchors, telescopic masts with fore and aft rig, boats on deck overhead, and all requirements for a first-class cargo steamer including Porter's patent derrick sockets for dealing with heavy lifts by combining the ship's ordinary derricks. Triple expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 24 in., 38 in. and 64 in. dia., with a piston stroke of 42 in. and two large steel boilers adapted for a pressure of 180 lbs. per square inch worked under Howden's system of forced draught.

Boyne.—On June 18th, Messrs. Joseph L. Thompson and Sons, Ltd., of the North Sands Shipbuilding Yard, Sunderland, launched the *Boyne*, the vessel having been specially constructed to the order of Messrs. The Mercantile Steamship Co., Ltd., of London, and being the thirteenth vessel the firm have built for this Company. The principal dimensions are :—Length about 388 ft., breadth, 51 ft. 6 in., and depth moulded 28ft. 9 in., and she will have two complete decks fully laid, and a poop, extra long bridge, and top-gallant forecastle. The vessel has been designed to have a large cubical capacity on a very moderate draught of water, and was greatly admired by the company present. The propelling machinery will be fitted by Messrs. Blair & Co., Ltd., of Stockton-on-Tees, the sizes of the cylinders being 25 in., 42 in., 68 in. by 48 in., supplied with steam by two large boilers working at 180 lbs. pressure.

Single-Deck Vessel.—On June 21st, Messrs. Wm. Doxford and Sons, Ltd., successfully launched a single-deck vessel of 360 ft. length, 50¼ ft. breadth, and 25½ ft. moulded depth, for Messrs. Giovanni Racich & Co., Ragusa. The vessel is designed to carry 6,800 tons deadweight on moderate draught, and has been constructed to British Corporation requirements. The engines, with cylinders 26 in., 42 in., 68 in., and 42 in. stroke, and the two boilers 16 ft. 9 in. by 10 ft. 10 in. have also been built by Messrs. Doxford.

Teeswood.—On June 22nd, Messrs. W. Harkess & Son, Ltd., launched from their shipbuilding yard at Middlesbrough a steel screw steamer, 145 ft. by 24 ft. 1½ in. by 11 ft. 7 in. moulded, which has been built to the order of the Meteor Steamship Co., Ltd., of Middlesbrough. She is specially designed with very large hatch and large cubical capacity to suit the owners' special coasting trade, and will carry about 500 tons on light draught. Her engines will be supplied by Messrs. Richardsons, Westgarth & Co., Ltd., of Middlesbrough. She has been built under the superintendence of Mr. William Constantine, to Lloyds' 100 A1 class. This is the third vessel built by these builders for the same owners.

Bampton.—On June 23rd, Messrs. Richardson, Duck and Co. launched from their yard a steel screw steamer of the following dimensions :—Length overall, 393 ft. 6 in. ; breadth extreme, 50 ft. ; depth, moulded, 28 ft., 11 in. ; with a deadweight carrying capacity of 7,500 tons. This vessel, which has been built to the order of Messrs. The Tatem Steam Navigation Co., Ltd., of Cardiff, will take highest class in British Corporation Registry, and has been built under special survey. She is a single-deck steamer with wide-spaced Channel frames—steel centre division is fitted in holds, in which there are no beams nor quarter pillars. Vessel has cargo poop, bridge amidships, and topgallant forecastle, with very large hatches to expedite the loading and discharging. A cellular double bottom for water ballast is fitted throughout except under boilers. Vessel has also peak tanks, and equipment includes seven steam winches exhausting into Contraflo Winch Condenser, large horizontal multitubular donkey boiler, fourteen derricks, steam windlass wich quick warping ends, steam-steering gear, etc., etc. The engines, by Messrs. Blair & Co., Ltd., have cylinders 25 in., 42 in., 68 in., by 45 in. stroke, steam being supplied by two extra large single-ended boilers having a working pressure of 180 lbs., and fitted with Howden's forced draught.

Canadian Transport.—On June 23rd, Sir Raylton Dixon and Co., Ltd., launched from their Cleveland Dockyard, Middlesbrough, the fine steel screw steamer *Canadian Transport*, being constructed to the order of the Empire Transport Co., Ltd., of London. The vessel will be classed 100 A1 at Lloyds, her principal dimensions being 377 ft. 6 in. by 51 ft. 2 in. by 28 ft. 4½ in. moulded, and she will have a deadweight carrying capacity of over 7,400 tons on a light draught of water.

Fridland.—On June 23rd, Messrs. William Gray & Co., Ltd., launched the handsome steel screw steamer *Fridland*, which they have built to the order of Messrs. Axol Brostrom and Son, Goteborg. She is built to the highest class in Lloyd's, and is of the following dimensions :—Length overall, 415 ft. ; breadth, 52 ft. 9 in. ; and depth, 28 ft. 6 in. ; and

is specially designed for the owners' Swedish iron ore and general trade, having poop, extra long bridge and topgallant forecastle. The cellular double bottom extends throughout and large after and fore-peak tanks and deep tank in after hold are fitted for water ballast. These with side ballast tanks of about 1,400 tons capacity give about 3,100 tons in all. Special pumps, pipes and valves are fitted, so that the whole of the ballast can be filled or emptied in less than ten hours. The side tanks (McGlashan's Patent) extend from the afterhold to the forehold, a length of 247 feet, in way of which the ship has double sides, which add to her strength and safety. They are specially designed for self-trimming, the wings being carried well into the hatch coamings. They are also of advantage when ore or coal cargoes are carried, presenting a smooth surface which is easily cleaned down, and preventing the lodgment of dirt which occurs in ordinary vessels behind stringers and between the frames. The extra ballast improves the speed of the vessel when running light and considerably reduces the "racing" of the machinery. It is under easy control and saves the cost and delay of shipping other ballast, which is often necessary to take on board to ensure a safe passage in ordinary vessels. Twelve extra powerful steam winches are fitted, two strong masts, four derrick posts, twelve derricks, with strong derrick gear, and two strong derricks for 10 and 15 ton lifts, steam-steering gear and hand screw gear aft, patent direct steam windlass, large horizontal multitubular donkey boiler of main boiler pressure, steam winch condenser, telescopic masts with fore and aft rig, boats on deck overhead, extra ventilation, room for installation of wireless telegraphy, electric lighting, and steam heating throughout, and a very complete outfit for a first-class cargo steamer. The machinery consists of a first-class set of triple-expansion engines and boilers capable of developing over 1,800 h.p., cylinders 27½ in., 43 in. and 73 in. diameter, with a piston stroke of 48 in. and two large main boilers to work at a pressure of 180 lbs. per square inch under Howden's system of forced draught, Weir's pumps and feed heater, and a number of "C.M.E.W." donkey pumps are fitted, also a bronze propeller and other specialities, all by the Central Marine Engine Works of the builders.

Bluebell.—On June 23rd, the s.s. *Bluebell*, the first of the two new passenger ferry steamers, built to the order of the Wallasey Urban District Council, was launched from the yard of Messrs. Cammell, Laird & Co. She is a steel twin-screw steamer, and her dimensions are as follows :—Length, 160 ft. ; beam, 38 ft. 6 in. ; and depth, moulded, 11 ft. 3 in. The vessels have been designed to carry about 1,400 passengers each, and are being handsomely fitted up and a complete system of electric lighting will be installed. They are being built to the highest class at Lloyd's for river purposes, and also in accordance with the latest rules and regulations of the Board of Trade. The whole of the machinery will be placed under the main deck, thus providing large saloon accommodation to which special consideration has been given in regard to heating and ventilating arrangements in order that passengers will be provided with every comfort possible. A small saloon has also been arranged in the after part of the after main saloon for the exclusive use of ladies, neatly decorated and provided with lavatory, etc. Watertight bulkheads are fitted throughout the vessels, fore and aft and athwartships, thus making them practically unsinkable in case of collision. Over the saloons there is an extensive promenade deck, which is carried out the full width of the vessels amidships, and the overhang of the deck at the ends is supported on brackets, this arrangement providing spacious accommodation and to a great extent sheltering the main deck below. The captain and helmsman's position is arranged on a flying bridge erected over the promenade deck, immediately forward of the funnel, so as to give an uninterrupted view ahead. Bilge keels are also fitted, to avoid excessive rolling in bad weather. The machinery is being constructed by the shipbuilders, and consists of two sets of triple-expansion engines, having cylinders 16 in., 24 in. and 41 in. diameter, with a stroke of 21 inches, and are to be supplied with steam from two powerful boilers.

Joseph Chamberlain.—On June 24th, Messrs. William Gray and Co., Ltd., launched the handsome steel screw steamer *Joseph Chamberlain* for Messrs. J. & R. O. Sanderson & Co., of West Hartlepool and Cardiff. She will take the highest class in Lloyd's Register, and is of the following dimensions :—Length overall, 361 ft. 6 in. ; breadth, 50 ft. ; and depth, 25 ft. 11 in., with long bridge, poop and topgallant forecastle. The hull is built with deep frames, cellular double bottom and large aft peak ballast tank, seven steam winches, steam-steering gear amidships, hand screw gear aft, patent direct steam windlass, large horizontal multitubular donkey boiler, shifting boards throughout, stockless anchors, telescopic masts with fore and aft rig, boats on deck overhead and all requirements for a first-class cargo steamer. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 25 in., 40½ in., and 67 in. diameter, with a piston stroke of 45 in. and two large steel boilers for a working pressure of 180 lbs. per square inch.

Bogstad.—On June 24th, Messrs. Osbourne, Graham and Co. launched from their yard at Hylton, Sunderland, the steel screw steamer *Bogstad*, which they have specially constructed for Messrs. Fearnley & Eger, of Christiania, being the third vessel they have built for this firm. She is built on the single deck principle with short poop and long bridge with all accommodation on top. Rooms for the Captain and officers are tastefully fitted out in hardwood and are of large size. The vessel carries 2,800 tons on a shallow draught, and is equipped with the most modern appliances for economical and quick working of cargo. She has been constructed under special rules to Norske Veritas Survey, and also fulfils the requirements of the Sjofartskontaret Rules. Water ballast is in both peaks and throughout double bottom, thus enabling steamer to take long passages light with the greatest safety. Engines and boilers will be supplied by Messrs. Geo. Clark, Ltd., of Sunderland, and are capable of driving the vessel at a speed of 9½ knots loaded. A Cochran (Annan) donkey boiler has been supplied fitted with patent seamless furnace.

Steel Screw Trawler.—On June 25th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 120 ft. by 21 ft. 6 in. by 12 ft. 3 in. moulded. The vessel has been built to the order of Messrs. The Great Central Co-operative Engineering and Ship Repairing Co., Ltd., of Grimsby, and will be fitted with powerful triple-expansion engines by them, and is replete with all the latest improvements for fishing purposes.

Thistleban.—On June 25th, Messrs. Craig, Taylor & Co., Ltd., launched from their Thornaby shipbuilding yard, Thornaby-on-Tees, a handsomely modelled single deck screw steamer of the following dimensions, *viz.* :—382 ft. by 51 ft. 4½ in. by 26 ft. 6 in. moulded. She is built of steel to the highest class in Lloyd's registry, under special survey, and has poop, long bridge and forecastle combined ; water ballast in double bottom fore and aft, and in peaks. She is equipped with patent direct steam windlass with quick warping ends, steam steering gear, eight steam winches, and multitubular donkey boiler, shifting boards in holds for carrying grain cargoes, telescopic masts to Manchester Ship Canal requirements, double derricks, and all the latest improvements for rapid loading and discharging. Her engines have been constructed by Messrs. Blair & Co., Ltd., Stockton-on-Tees, the cylinders being 26 in., 42½ in., 69½ in. by 45 in., with two large steel boilers working at 180 lbs. pressure. The vessel has been built to the order of The Albyn Line, Ltd., Messrs. Allan, Black & Co., Sunderland, Managers.

Thames.—The Goole Shipbuilding & Repairing Co., Ltd., lately launched from their Victoria Shipyard, Goole, a steel screw steamer of the following dimensions :—145 ft. B.P. by 24 ft. beam by 11 ft. 10 in. depth moulded. The vessel is designed to carry about 500 tons deadweight, and is being built to Lloyd's highest class, with long raised quarter-deck and topgallant forecastle. She is fitted up in the most modern way for the quick discharging of cargo, and has two steam winches, and a steam and hand steering gear. She has a cellular double bottom the full length of the hold. Triple-expansion engines of good power will be fitted by Hull engineers. The vessel is being built to the order of E. P. Hutchinson, Esq., Hull, and was named *Thames*, and is the fourth steamer built for the same owner.

Forestmoor.—On July 3rd, there was launched from the shipbuilding yard of Messrs. John Blumer & Co., North Dock, Sunderland, the screw steamer *Forestmoor*, for Messrs. Walter Runciman & Co., of Newcastle and London. She

is of the single deck type with poop, bridge, and forecastle, perfectly clear holds, and is specially adapted for the big timber trade and to carry a large deadweight on a light draught. Water ballast is provided in the double bottom and also in after peak tank. The accommodation for Captain and officers is on the bridge at the fore end, and for the engineers at after end of bridge. The discharging gear is thoroughly up to date in every respect. Engines will be fitted by Messrs. John Dickinson & Sons, Ltd., and the winches and steering gear by Messrs. John Wigham & Son, of Hulton, and the windlass by Messrs. Emerson, Walker and Thompson Bros., Ltd.

Darlington.—On July 5th, the *Darlington*, a handsomely modelled screw steamer built to the order of Messrs. Wilsons and North Eastern Railway Shipping Co., Ltd., was successfully launched from the yard of Messrs. Earle's Shipbuilding and Engineering Co., Ltd., Hull. The principal dimensions of the vessel are :—Length, 255 ft. ; breadth, 36 ft. moulded ; depth, 17 ft. 4 in. moulded. She has been constructed of steel throughout to Lloyd's 100 A1 class, and to Board of Trade latest requirements. The vessel is of the single deck type with long poop and forecastle, saloon and boat decks extending over accommodation amidships. Two steel pole masts are arranged to take six large derricks for the speedy handling of cargo, these derricks being capable of lifting from three to ten tons each. In addition to these there are steel derrick towers amidships, the whole of the derricks being worked by five powerful steam winches, and on the forecastle an efficient steam windlass by Messrs. Clarke, Chapman & Co. is fitted. The steering gear for the vessel is composed of steering engine placed at aft end of engine casing and worked by the telemotor system from navigating bridge, also hand screw gear aft by Messrs. Amos & Smith, Hull. The ship will be fitted up with a complete electric light installation, also system of electric bells. All the officers and engineers' living rooms are heated by steam radiators, and all work throughout the vessel is of the very best description and latest improvements. The machinery consists of a set of triple-expansion engines, having cylinders 23½ in., 38 in., 62 in. by 39 in. stroke, supplied with steam by two large cylindrical boilers working under forced draught at a working pressure of 180 lbs. per square inch, the whole of the machinery being to Lloyds' requirements and of the very best quality and finish.

Usworth.—On July 6th, the screw steamer *Usworth*, built by Messrs. John Readhead & Sons, Ltd., for the Gordon Steam Shipping Co., Ltd., of London, was launched from the West Dock Shipyard, South Shields. The vessel is of the improved single deck type, with large holds clear of beams and other obstructions in stowing cargo, and is of the following dimensions :—Length overall, 333 ft. by 48 ft. beam by 23 ft. 10 in. depth moulded, and carries a large cargo on a light draught of water. There is a long bridge amidships extending beyond the engine and boiler space, and on which are situated the steel deck houses containing the cabins for Captain, officers, engineers and apprentices, over which again are placed the steel chart and wheel houses, pilot bridge, etc. A topgallant forecastle contains the accommodation for crew and firemen, etc., and there is a large cargo poop aft. The arrangements for the loading and discharging of cargo are full and complete, there being seven powerful steam winches to work the nine derricks which feed large hatchways into the hold. Steam is supplied from a large multitubular donkey boiler of marine type. Wood shifting boards and feeders are also fitted throughout for carrying grain cargoes, and a large quantity of water ballast is carried throughout the double bottom and also in the after peak. The engines and boilers have also been constructed by Messrs. John Readhead & Sons, Ltd., the cylinders being 23½ in., 39 in., and 64 in. diameter by 42 in. stroke, with two boilers 180 lbs. pressure. The vessel is built to Lloyd's highest class and to their special survey.

LAUNCHES—Scotch.

Ilheos.—On July 7th, the Ailsa Shipbuilding Co., Ltd. launched at Troon a twin-screw passenger steamer, built to the order of Messrs. John F. Campbell & Son, Glasgow, for South American owners. The dimensions of the vessel are : Length, 200 ft. ; breadth, 32 ft. ; and depth, 11 ft. 10 in., moulded to main deck. The vessel is built to class 100 A1 at Lloyd's for South American coasting. Accommodation is provided for fifty-four first-class and twenty-four second-class passengers. Twin triple-expansion engines will be fitted, designed to give the vessel a speed of 12½ knots.

Princess Adelaide.—The Fairfield Shipbuilding & Engineering Co., Ltd., recently launched the screw steamer *Princess Adelaide*, built to the order of the Canadian Pacific Railway Co. for their passenger and package freight traffic between Seattle, Vancouver, Victoria and Skagway. The *Princess Adelaide* is similar in design to the *Princess Charlotte*, built by the Fairfield Company in 1908, and is the sixth vessel constructed by them for the Canadian Pacific Railway Company. The dimensions of the vessel are :—Length, 290 ft. ; breadth, 46 ft. ; and depth, 32 ft. 6 in. She will have a speed of 17¾ knots. Accommodation will be provided for 240 first-class and 960 second-class passengers, and on the lower deck aft there will be a restaurant to seat ninety-eight persons. The design was prepared by Captain Troup, of the Canadian Pacific Railway Company, Vancouver, and care has been taken to ensure the comfort of passengers. A special feature of the vessel is the observation room situated on the promenade deck forward. It has large plate-glass windows and raised seats, from which to view the scenery on the route. The propelling machinery consists of a set of four-cylinder triple-expansion engines, and steam will be supplied by six single-ended boilers.

Charmouth.—On July 8th, a steam trawler, built to the order of Messrs. Sellick, Morley & Price, Milford Haven, was launched at Aberdeen. The dimensions of the vessel are :—Length, 121 ft. ; breadth, 21 ft. ; and depth, 12 ft. 9 in. The trawler, which was named the *Charmouth*, will be fitted with triple-expansion engines.

Den of Glamis.—Recently Messrs. Napier & Millar, Ltd., of Old Kilpatrick, launched a steel steamer of about 5000 tons gross, named *Den of Glamis*, for Messrs. Charles Barrie and Son. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel was applied to the bunkers, and their "Bitumastic" covering to tank top under boilers.

LAUNCHES—Irish.

Kansas.—On June 26th, Messrs. Workman, Clark & Co., Ltd., Belfast, launched from their South Yard a large steamer built by them to the order of the Bucknall Steamship Lines, Ltd., London. The new vessel, which has been named the *Kansas*, is 488 ft. in length with a gross tonnage of over 6000, and has been built under British Corporation Survey for the highest class in their registry. The cargo space is divided into five spacious holds practically free of obstruction, and thus capable of receiving consignments of the largest nature, such as locomotives, boilers, etc. The hatchways to each of these holds have been made as large as possible to facilitate the loading of the above class of goods and are equipped with steam winches, derricks and all the necessary appliances for handling heavy and bulky cargo. Accommodation for the captain, officers and engineers is provided in steel houses on the bridge deck, while the crew will be berthed in side-houses below the forecastle deck. The propelling machinery consists of a set of triple-expansion engines having all the necessary auxiliary appliances and supplied with steam from three single-ended multitubular steel boilers working under an approved system of forced draught.

Gloucestershire.—On July 7th, Messrs. Harland & Wolff, Ltd., launched the large steel screw steamer *Gloucestershire*, built to the order of the Bibby Line of Liverpool. The new vessel is about 483 ft. long by 54 ft. beam, and 8100 tons. She will have four masts, schooner rigged, and will be equipped with powerful steam windlass and winches, patent steering gear, etc. The *Gloucestershire* will have two sets of Messrs. Harland & Wolff's latest type quadruple-expansion engines arranged on the "balanced" principle. As in the other vessels of this Line, the state-rooms will be arranged on the Bibby "tandem" principle, all the rooms being lighted with side lights from the outside. The advantages of this arrangement are greatly appreciated by passengers, especially those travelling to the East. The vessel will be provided with an installation for wireless telegraphy, also submarine signalling, and other latest improvements for ensuring the safety and comfort of the passengers.

TRIAL TRIPS.

Tungku Miriam. On May 24th the motor launch, *Tungku Miriam*, which has been built to the order of the Crown Agents for the Colonies by Messrs. J. I. Thornycroft & Co., Ltd., at Woolston, was taken for her official speed and towing trials on the measured distance on the river Itchen at Southampton. The principal dimensions of the launch are—Length, 36 ft. 3 in.; beam, 9 ft.; depth moulded, 2 ft. 10 in., the draught loaded not exceeding 15 in. The launch is sub-divided into six water-tight compartments by means of steel bulkheads. A permanent awning to sun deck extends all fore and aft, the forward end of this deck being suitably arranged as a steering position. The propelling machinery consists of a powerful six-cylinder paraffin motor driving two propellers on a common shaft working in a tunnel. The mean speed of the launch when fully loaded averaged over 11 miles per hour running free, and she also showed a good turn of speed when towing a heavy lighter. The launch is intended for special service in shallow rivers in the Federated Malay States.

Cape Transport.—On May 25th, the finely modelled steel screw steamer *Cape Transport*, built by the Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne, to the order of Messrs. Furness, Withy & Co., Ltd., for the Empire Transport Co., Ltd., London, left the Tyne to undergo her official trial trip. Her dimensions are 365 ft. long by 51 ft. 4½ in. beam by 28 ft. 4½ in. deep, and is designed to carry about 7350 tons on a light draught. The deck erections consist of long bridge, long poop, topgallant forecastle, the accommodation which is ample, being placed in steel houses on the bridge deck. The steamer has been specially designed for the rapid loading and discharging of homogeneous cargoes, the hatchways being very long and wide and are arranged for grain carrying in bulk, a complete set of shifting boards being fitted throughout to latest Board of Trade requirements. Ample deck gear is provided consisting of three steam winches by Messrs. John Lynn & Co., Ltd., Sunderland, and a large number of cargo derricks to ensure the expeditious handling of cargoes. The usual water ballast arrangements for light passages are provided for. The machinery has been supplied by Messrs. Richardsons, Westgarth & Co., Ltd., Sunderland, consisting of engines with cylinders 25 in., 40 in. and 67 in. by 45 in. stroke, three large steel boilers with 100 lbs. pressure. The trial trip proved in every way highly satisfactory, and a speed of 11 knots was easily obtained.

Impoco.—On May 27th, the new steamer *Impoco*, built to the order of the Anglo-American Oil Co., London, carried out her official trials under loaded conditions on the measured mile at Skelmorlie. Afterwards she returned to the Tail of the Bank, where compasses were adjusted. On the run between the Cloch and Cumbrae lights a mean speed of 10·6 knots was attained, everything working smoothly and giving entire satisfaction to all concerned. The *Impoco*, which is an oil-tank steamer, has a set of triple-expansion engines, having cylinders 19 in., 32 in. and 53 in. by 36 in. stroke, supplied with steam at 190 lb. On completion of the trial trip the vessel returned to the Tail of the Bank, and sailed on May 31st on her maiden voyage.

Canonbar.—On May 28th, the steamer *Canonbar*, which has been built at Ardrossan for Australian owners, ran trials on the Clyde. The trial proved satisfactory, and a speed of fully half a knot over that guaranteed was attained. For launch, see May issue.

Kwarra.—On May 30th, the fine steel screw cargo and passenger steamer *Kwarra*, built by Messrs. Sir Raylton Dixon & Co., Ltd., of Cleveland Dockyard, Middlesbrough, on the well-known patent cantilever frame type, to the order of Messrs. Elder, Dempster & Co., of Liverpool, proceeded to sea for her official trials. She is built to Lloyd's highest class with complete shelter deck and topside water ballast tanks under upper deck and engines amidships. Her principal dimensions are 373 ft. 6 in. by 52 ft. by 28 ft. 8 in. moulded, and she will carry a deadweight cargo of about 8100 tons or over 3½ times her net register, which is only about 2300 tons. The vessel has five holds, which are absolutely free from all obstructions such as beams, pillars or webs, and are perfectly self-trimming owing to the sloping sides of the topside tanks. Access to these holds is obtained by four extraordinarily large hatchways, the largest of which are 33 ft. 6 in. long by 24 ft. wide. The vessel carries the unusually large quantity of about 2500 tons of water ballast, of which over 1300 tons is contained in the topside tanks and can be discharged in twenty minutes without pumping, and consequently the vessel when in water ballast condition will be in excellent trim for maintaining speed and capable of going to sea in any weather. The vessel also has two masts, ten derricks, nine powerful steam winches, windlass, steam steering gear, six water-tight bulkheads and a complete installation of electric light and fire extinguishing together with all the latest and most modern appliances for the comfort of passengers and rapid handling of cargo. She has been fitted with triple-expansion engines by Messrs. North-Eastern Marine Engineering Co., Ltd., Wallsend-on-Tyne, having cylinders 26 in., 42 in. and 70 in. by 48 in. stroke supplied with steam by three large single-ended boilers working at 180 lbs. pressure and fitted with Howden's system of forced draught. The trials passed off most successfully, and the vessel proceeded in ballast direct to Montreal.

Popular.—The trial trip has been recently run of a new steam passenger steamer, the *Popular*, designed and built by Edward Hayes, of Stony Stratford, which is to ply between Lisbon and Cacilhas; she is about 60 ft. long, 13 ft. wide and draws about 4 ft. of water. High casings are built on which are placed seats for passengers of which she carries about eighty altogether; spacious cabins are placed forward and aft, and a lobby entrance and lavatory between for cabin and boiler bulkhead, a stout awning extends fore and aft, carried upon a galvanized steel framing, special arrangements are made for good ventilation and, to facilitate the quick embarkation of passengers, the bulwarks are made to slide aside in places to give a wide entrance. She is lighted throughout by acetylene gas, a powerful searchlight also being placed forward so that she can steam at full speed through the moorings on the Tagus at night. The machinery consists of a "Hayes" standard compound surface condensing engine having cylinders 8 in. and 16 in. by 10 in. stroke, running at 260 revolutions per minute, steam is supplied by an ample marine boiler built under Lloyd's survey for 120 lbs. pressure. On her trials she averaged 12·67 miles, which was well in excess of her contract speed, she ran very smoothly, was found to be a very dry boat in rough weather and easily handled.

Cheslakee.—On June 1st, the s.s. *Cheslakee*, which has been built by the Dublin Dockyard Co., to the order of the Union Steamship Co., of British Columbia, left the Abercarn Basin, Belfast, having been loaded to her working condition, for the purpose of undergoing official trials on the measured mile. The vessel is constructed in accordance with Colonial ideas and although comparatively small has no less than three decks besides the 'tween decks. The equipment of the vessel is practically complete, including the usual steam auxiliaries on deck and duplicate electric light sets, either of which is capable of fully lighting the vessel. There will also be a powerful searchlight and the life-saving appliances are unusually ample, there being no less than five boats, which, together with the appliances for extinguishing fire, are in conformity with the requirements of the Canadian authorities, as well as the British Board of Trade. The machinery has been supplied by Messrs. MacColl & Co., of Belfast, and consists of a set of triple-expansion engines having cylinders 13½ in., 22 in. and 36 in. by 20 in. stroke, and suitable for working at a pressure of 185 lbs. The boiler is of the multitubular Scotch type and specially large for burning coal of an inferior quality, and all the usual auxiliaries for economical working have been installed. The guaranteed speed of the vessel was 11½ knots, but on a mean of six runs on the measured measured mile a speed of 12·15 knots was obtained. The trials extended over a period of nine hours during which time the machinery worked with the utmost smoothness. See also launch, May issue.

Onitsha.—On June 2nd, the new steamer *Onitsha* proceeded on her official trial trip after adjusting compasses in Hartlepool Bay. The trials were in every way satisfactory, a mean speed of fully 12 knots being attained. A large party attended the trial trip. See launch, May issue.

British Transport.—On June 2nd, the fine steel screw cargo steamer *British Transport* proceeded to sea for her official trials. Captain F. Ellis will command the vessel. See launch, June issue.

Murital.—On June 8th, the new twin-screw steamer *Muritai* left Messrs. Workman, Clark & Co.'s finishing berth at the Milewater Basin and proceeded down Belfast Lough to the Carrick Roads, where compasses were adjusted, after which the speed trials were run on the measured mile course. These were highly satisfactory, and the vessel afterwards left the Lough for Barry to take in coal. She will load in London preparatory to leaving for her initial voyage to Australia. For launch, see May issue.

Janus.—On June 9th, the steel screw cargo and passenger steamer *Janus*, built by Messrs. Palmers Shipbuilding and Iron Co., Ltd., Jarrow, to the order of Messrs. Archibald Currie & Co., of Melbourne, was taken to sea for her official trials. The vessel was run for over three hours, the mean speed achieved being 13½ knots on the mile. The engines worked very smoothly throughout, the trial being highly successful in every respect. For launch, see May issue.

Norhilda.—On June 9th, the *Norhilda* went for a very successful trial trip off the Tyne. She afterwards sailed for her loading port, Calais, under the command of Captain Durie. During the trial trip the machinery worked without the slightest hitch, driving the vessel at a speed of 10 knots per hour. For launch, see June issue.

Remembrance.—On June 9th, a first-class cargo steamer, built to the order of Messrs. The Freear & Dix Steam Shipping Co., Ltd., Sunderland, proceeded to sea on her trial trip. The managing directors of the purchasing company were present with a large party of friends, and everyone expressed entire satisfaction with the vessel and machinery. For launch, see June issue.

Triton.—On June 9th, a finely modelled steamer of the partial awning deck type, built for Messrs. The Dampfschiff-fahrts-Gesellschaft "Neptun," of Bremen, proceeded to sea on her trial trip. Her principal dimensions are:—Length, B.P., 225 ft.; breadth extreme, 35 ft.; depth moulded, 16 ft. 6 in.; and she is classed 100 A1 at Lloyd's. Water ballast is provided in the cellular bottom and after peak. There are four cargo hatches, each worked by a powerful steam winch for rapid loading and discharging, and a multitubular donkey boiler of ample capacity, also steam windlass and steam and hand steering gear. The engines are of the triple-expansion type, by Messrs. MacColl and Pollock, Ltd., having cylinders 17 in., 28½ in. and 46 in., with a stroke of 33 in., steam being supplied by an extra large boiler working at a pressure of 180 lbs. per square inch. The owners' superintendent, Mr. S. Siemens, expressed himself entirely satisfied with both vessel and machinery, the engines running with the utmost smoothness, a mean speed of over 10 knots being easily attained. Messrs. Cochran and Co. (Annan), Ltd., have supplied one of their Cochran (Annan) donkey boilers fitted with patent seamless furnace.

Harpagus.—On June 11th, the *Harpagus* was taken out to sea. A speed of 13½ knots was obtained, the performance of ship and machinery being entirely satisfactory. After the trial the vessel proceeded on her voyage under the command of Capt. Johnson. For launch, see June issue.

Lisboa.—On June 14th, the handsomely modelled twin-screw passenger and mail steamer *Lisboa* ran her trials on the Firth of Clyde. On trial, the vessel attained a mean speed of 16½ knots, which is well above the speed required. The machinery, during the trials, worked smoothly, and to the entire satisfaction of owners and builders. After trial trip the vessel proceeded direct to Lisbon. For launch, see June issue.

Atland.—On June 15th, the s.s. *Atland*, a large and well-equipped single-deck turret vessel, left the Tyne for a coast trial trip which was in every way successful. The engines, with cylinders 26 in., 42 in. and 72 in. dia. and 48 in. stroke, and the two boilers 16 ft. 9 in. by 12 ft., with Howden's forced draught, have been constructed by Messrs. Doxford, and gave to the vessel a speed of 12¼ knots on the measured mile—a most satisfactory result. For launch, see June issue.

Natal Transport.—On June 16th, the *Natal Transport*, built by the Northumberland Shipbuilding Co., Ltd., Howdon-on Tyne, to the order of Messrs. Furness, Withy & Co., Ltd.. for the Empire Transport Co., Ltd., London, left the Tyne to undergo her official trial trip. The trial trip proved in every way highly satisfactory, and a speed of 11 knots was easily obtained. On the conclusion of the trial trip the vessel returned to Tyne Dock for bunkering. For launch, see June issue.

Lincluden.—On June 18th, this vessel left Sunderland for her official trial trip, having just been completed by Messrs. Joseph L. Thompson & Sons, Ltd., of the North Sands Shipbuilding Yard, Sunderland, to the order of Messrs. The Lincluden S.S. Co., Ltd. (Messrs. Sivewright, Bacon & Co., Ltd., managers), of Manchester. The trial was most succesful in every way, the machinery and auxiliaries running smoothly and giving every satisfaction, and a mean speed of about 11½ knots being easily attained. See Launch in July issue.

Malaespera.—On June 24th, the patent cantilever framed steamer *Malaespera*, built by Messrs. Sir Raylton Dixon and Co., Ltd., at their Cleveland Dockyard, Middlesbrough, to the order of Messrs. Ocharan & Aburto, of Bilbao, proceeded to sea for her official trials, which passed off most successfully and the vessel proceeded to the Tyne to load a cargo of coal for St. Nazaire. See Launch in July issue.

FOREIGN TRIAL TRIP.

Radioleine.—On May 22nd, the steamer *Radioleine*, which has been built at Rouen to the order of the Société Petroles-Transports of Marseilles, was taken for trial at sea. Her engines are 24½ in., 40½ in. and 66½ in. in diameter, with a stroke of 48 in., supplied with steam by two single-ended boilers. The steamer is built to the highest class of Bureau Veritas. For Launch, see May issue.

BOARD OF TRADE EXAMINATIONS.

NOTE—1C denotes First Class: 2C Second Class.

May 19th.

Bald, H. B.	1C	Leith
Barclay, A. M'C	1C	London
Bartlett, W. B.	1C	Liverpool
Baird, W. G.	1C	London
Braidwood, T. P.	2C	South'ton
Brierley, F. J.	1C	South'ton
Campbell, W. B.	2C	South'ton
Cargill, F. J.	1C	Liverpool
Carr, J. L.	1C	N. Shields
Clemens, R.	2C	Plymouth
Clarke, G. J.	2C	London
Crocker, R. W.	2C	Cardiff
Cox, C. F.	1C	Liverpool
Davies, Owen	1C	Cardiff
Dall, Andrew	2C	Liverpool
Dickinson, T. H.	1C	Liverpool
Douglas, J.	1C	W. Hart'l
Downie, P.	1C	Glasgow
Ekbery, G.	1C	Liverpool
Farminer, E.	2C	Cardiff
Fisher, A.	1C	W. Hart'l
Gill, H.	1C	Cardiff
Goodall, W. P.	2C	South'ton
Gower, S. T.	1C	N. Shields
Goldsbrough, W.	1C	N. Shields
Graham, T.	2C	N Shields
Hastie, G. H.	1C	N Shields
Heads, E. A.	2C	N Shields
Jenkins, L.	1C	Cardiff
Jolly, P. S. B.	1C	Glasgow
Jones, E. R.	1C	Cardiff
Kean, J. W.	2C	W. Hart'l
Kilgour, F. R. T.	2C	Glasgow
Laird, Martin	2C	Glasgow
Leaity, W. F.	1C	London
Louden, A. W.	2C	Leith
Macdonald, K. M.	1C	Glasgow
M'Gregor, A. T.	1C	South'ton
M'Knight, H. A.	2C	Liverpool
Pearson, H.	1C	W. Hart'l
Peterson, S. S.	2C	W. Hart'l
Pollock, L.	2C	Barrow
Richards, J. T.	1C	Cardiff
Robson, J. R.	1C	W. Hart'l
Rodger, M.	1C	Glasgow
Savours, G.	1C	Cardiff
Sergeant, A. T.	1C	Liverpool
Scott, W.	1C	N. Shields
Stenner, E. M.	2C	Cardiff
Squires, S. J. F.	1C	London
Tait, H.	1C	N. Shields
Todd, L.	1C	W. Hart'l
Tomkins, A. R.	1C	N. Shields
Thomas, W.	1C	Glasgow
Thornton, J. A.	1C	Liverpool
Turnbull, A.	2C	N. Shields
Webb, A. M.	2C	London
Williams, E. L.	2C	Liverpool
Williams, S.	1C	Barrow
Yonge, G. C.	1C	Liverpool

May 26th.

Adamson, T. J.	2C	Hull
Barclay, J. A. S.	2C	Aberdeen
Beaton, R.	2C	Greenock
Bellman, A. S.	2C	Greenock
Burton, Fred	1C	Hull
Clay, G. W.	1C	Hull
Corstorphine, D	2C	Greenock
Cowle, P. G.	2C	Liverpool
Davies, D. T.	1C	Liverpool
Davidson, J.	1C	Aberdeen
Davidson, J. D.	2C	Bristol
Doig, E. N.	1C	London
Eastwood, C. H	2C	Hull
Edwards, J.	2C	Liverpool
Fouhy, M. E.	2C	London
Fraser, J.	1C	Aberdeen
Frisken, A.	2C	Aberdeen
Fyffe, H.	2C	Aberdeen
Gale, J.	2C	Hull
Green, G.	2C	Greenock
Ingleby, G. W.	2C	Hull
Jolliffe, G. H.	1C	Hull
Knox, G. F.	1C	Hull
Lackie, J.	1C	Aberdeen
Lovell, W. E.	2C	Greenock
Magee, T. R.	1C	Hull
Marsh, H.	2C	Bristol
Milne, R. F.	2C	Aberdeen
Potter, A. O.	1C	Liverpool
Petty, J. M.	1C	Hull
Ross, P.	2C	Aberdeen
Ross, A. S.	1C	Aberdeen
Scott, T. D.	1C	Greenock
Tanner, R. H.	2C	Liverpool
Underhay, S. G	2C	Liverpool
Williamson, G.	2C	London
Wrigglesworth, W.	2C	Hull]

June 2nd.

Aitken, A.	2C	Leith
Batey, T. W.	2C	N.Shields
Baillie, John	1C	N Shields
Blair, John	2C	Glasgow
Blair, John	1C	N.Shields
Blanche, Robt.	1C	N.Shields
Bowler, C. H.	2C	Liverpool
Brace, A. W.	2C	South'ton
Carnegie, J.	1C	South'ton
Clarke, J. R.	1C	Liverpool
Davies, P. W.	1C	Liverpool
Dennis, W. C.	2C	Cardiff
Duncan, John	1C	Leith
Evans, W. E.	2C	Cardiff
Fawcett, J. R.	2C	N.Shields
Francis, G. W.	2C	Glasgow
Frangopoulo, S.	2C	South'ton
Frostick, R. J.	2C	South'ton
Gardner E. E.	2C	South'ton
Graham, D	2C	Glasgow
Hudson, F. A.	1C	N.Shields
Irwin, Roy	1C	N Shields
Jones, G. E.	1C	London
Leathem, Fred	2C	Belfast
Livanos, S	2C	Cardiff
Mackenzie, A. I.	2C	N Shields
Maclean, W. J.	2C	Cardiff
Marshall, S. A.	1C	London
Matthew, A. W.	1C	London
Miller, R. S.	2C	N.Shields
Moore, W. L. S.	2C	Glasgow
Morgan, G. W.	1C	Cardiff
M'Cormick, R. G.	1C	Glasgow
M'Donald, D.	2C	Glasgow
M'Kinlay, R.	2C	Glasgow
Paterson, John	2C	Leith
Pattullo, G. D.	1C	Leith
Parker, P. F.	1C	Glasgow
Pritchard, H.	2C	Liverpool
Radford, S. P.	1C	Liverpool
Rae, J.	2C	Glasgow
Reive, George	2C	N.Shields
Rickinson, L.	1C	London
Roche, F. J.	1C	Falmouth
Scott, E.	1C	Glasgow
Simpson, G. C.	2C	Leith
Thurlbeck, G. H.	2C	N.Shields
Vasey, J. C.	1C	Liverpool
West, F. T.	2C	London

June 9th.

Adams, J. A.	2C	Liverpool
Arnold, A. J.	2C	London
Bodill, W. R.	2C	Liverpool
Colledge, E.	2C	N Shields
Davies, Griffith	2C	Liverpool
Kershaw, R.	2C	N.Shields
Landreth, W.	1C	N.Shields
Manson, F.	1C	N Shields
Metcalf, D.	2C	Liverpool
Morton, Arthur	2C	Liverpool
Oxenham, G. S.	1C	London
Paterson, J. A.	2C	Liverpool
Pyves, R. H.	1C	N Shields
Rose, John F.	1C	N.Shields
Steel, John H.	1C	Liverpool
Thomas, S. E.	1C	Liverpool
Webster, P. S.	2C	N.Shields
Williams, L. P.	2C	London
Wright, R. A.	2C	N.Shields

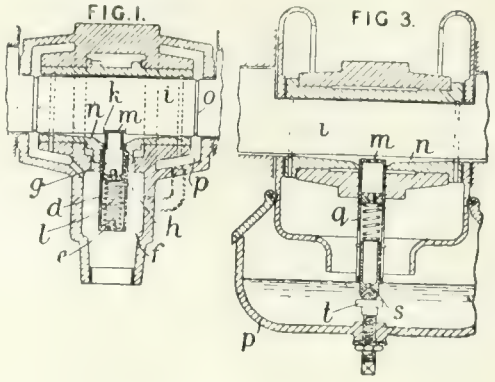
June 16th

Addison, F. W.	1C	Liverpool
Baker, G. W.	2C	N.Shields
Barraclough, J.	2C	Hull
Barkley, W. F.	1C	Liverpool
Beeson, E. B.	2C	Liverpool
Brodie, J. V.	1C	Greenock
Cliffe, H.	2C	London
Coote, W.	2C	Liverpool
Costigan, R.	1C	N.Shields
Crawford, R. B	1C	London
Cuff, Fred C.	1C	Liverpool
Dadswell, E.	1C	London
Drew, E.	2C	N Shields
Enocks, W	1C	London
Ellis, Tom	1C	Liverpool
Flett, J.	2C	Liverpool
Fleck, W. G.	2C	N Shields
Forsyth, A.	1C	London
Gourlay, A. J.	1C	London
Kerr, A.	2C	Dundee
Klee, F. H.	1C	N Shields
Milne, A.	1C	Greenock
Mitchell, D. M.	2C	Liverpool
Murray, T. C.	1C	Greenock
M'Kenzie, J.	1C	Greenock
Nicoll, A.	1C	Dundee
Page, James	1C	Dundee
Quilleash, T. M'S	2C	Liverpool
Rankin, J.	2C	Greenock
Reid, A.	2C	Liverpool
Smith, H.	2C	London
Smith, E. W.	2C	Hull
Thornton, T. E.	2C	Hull

The Marine Engineer and Naval Architect Patent Record.

Compiled by Messrs. F. P. Alexander & Son, Chartered Patent Agents, 306, High Holborn, London, W.C.

2633. Lubricators. A bearing for shafts is lubricated automatically by a pump operated in one direction by a spring and in the other by the rotation of the shaft, and oil is delivered directly on to the part to be lubricated through outlets which are constantly in motion. As shown in Fig. 1 the shaft has an eccentrically-stepped portion *i*, and the bearing executes a circular movement which may be transmitted to a shaking-sieve, etc. The pump cylinder *d* is fixed in the lower bearing-bush and projects into an oil reservoir *f*. A hollow piston *g*, pressed upwards by a spring *l*, is operated by a flat portion *k* or by an eccentric groove in the shaft. Oil is drawn through valves *e*, *h* and is delivered through openings *m* to a groove *n* in the bearing. Grooves *o* intercept surplus oil, which returns to the reservoir by passages *p*. Fig. 3 shows a modification in which the oil reservoir *p* is fixed. The pump *q* oscillates with the bearing, and its plunger *s* is operated by striking an adjustable block *t*. The oil from pump may be conveyed to any desired points on the shaft by pipes *v*, Fig. 5, provided with discharge orifices *u*. One pipe only may be used, extending wholly or



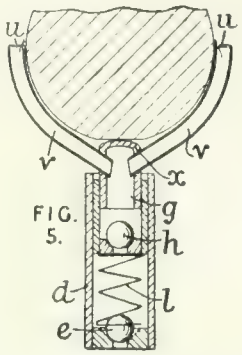
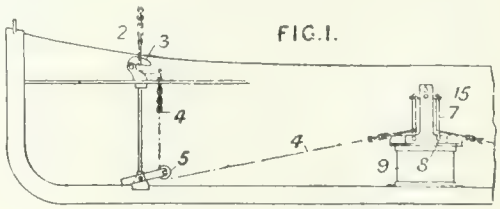
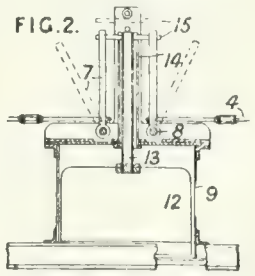


FIG. 5.

partly around the shaft. Oil is delivered also through an opening *x* in the piston *g*.

3125. Boat-disengaging gear. Relates to means for simultaneously disengaging the supporting-hooks from the falls by the action of a float, which through a rigid connection releases trigger-levers when the boat is water-borne. The trigger-levers 7, pivoted at 8 to a casing 9, are connected to tilting-hooks 3 engaging the falls 2 by a chain, etc., 4.





A float 12 works in the casing 9, the bottom of which is open to the sea. A rod 13 guided by a tube 14 is carried by the float, and is provided with a cross-bar 15, which normally engages the ends of the trigger-levers. When the boat is water-borne, the float rises and the trigger-levers are released. In a modification, the cross-bar is fitted with knuckle-levers to facilitate resetting the trigger-levers.

The Marine Engineer

And Naval Architect.

LONDON, SEPTEMBER, 1910.

OIL MOTOR LINER.

THE rumour that a German shipping company was contemplating the use of oil engines for a liner has been substantiated by the announcement that the Hamburg-American Company has ordered from the well-known shipbuilders, Messrs. Blohm and Voss, of Hamburg, an Atlantic liner of 9,000 tons displacement, which is to be fitted with oil engines of 3,000 horse power. The vessel is to have a speed of between 12 and 13 knots and is to be used for cargo purposes. It is understood that twin propellers are to be used, driven direct by two oil engines of the Diesel type at about 150 revolutions per minute. We feel sure that, although this pioneer effort is not British, but German, our good wishes in respect of, and admiration for, the enterprising policy of the board of directors of the Hamburg-American Company are none the less sincere. The internal combustion engine, burning crude oil, has already been shown to be capable of doing good and reliable work for marine purposes, and it may be said that shipbuilders have a thorough appreciation of its merits as a motor engine on a moderate scale. The step to be now taken by the Germans is a long one in point of anything previously done, the largest oil engine at present afloat being about 300 horse power; but it may be mentioned that a private steam yacht is having its steam equipment substituted by a Diesel oil engine of 500 horse power. Much has been done on shore with the oil engine in powers ranging up to 1,000 horse power, and to no firm is more credit due for steady progress than to the Diesel Company, who have, we understand, constructed a single-cylinder engine of 1,000 horse power. The development of the oil engine on a large scale has been slow for marine purposes, not so much owing to engineering difficulties or want of enterprise on the part of manufacturers, but to the diffidence of shipowners in adopting the oil engine, and it has been left to the German shipowner to show us the way. There are many advantages which will accrue from the use of crude oil: First, the danger is practically *nil*, as the flash-point is high, *viz.*, 250°F.; secondly, the tank capacity for oil is less than the space for coal; thirdly, the Diesel oil engine will give about one-brake horse power for each half-pound of crude oil burnt, while for the same power in a steam engine 2 lbs. are required, so that on this basis only 25 per cent. of fuel is required for oil compared with that for coal; and, fourthly, immense saving in space and weight will be effected in the machinery and its place of installation, permitting a corresponding increase in cargo-carrying capacity and earning power, and a decrease in number and cost of staff for the engine-room, particularly in the matter of firemen, the necessity for whom will be practically *nil* owing to the facility for automatically handling liquid fuel. When all these factors are taken into consideration, it is easy to understand that the weight of fuel and machinery per ton carried will be much decreased, while the unit of weight of cargo carried per unit of cost of ship and running the same will be enormously increased. It is quite easy to appreciate therefore that the oil engine alone could turn a profitless ship into a profitable one. In these days of low freights and conditions of general depression in the shipowner's business an experiment such as the one in hand should be warmly welcomed, although from a narrow standpoint the commercial development of the new type of vessel will no doubt increase the number of non-profit-earning vessels. This may be bad for the individual shipowner, but must be directly beneficial to the world at large. What the shipowner has to do, after having had the proof of the merits of the new vessel demonstrated to him, is to consider the commercial policy as to how far it is wise or desirable to allow the investment of capital to remain in a concern incapable of giving an adequate return by way of profit. Another point of interest as affecting the marine engineer is in the event of the wide adoption of oil engines, how much reduction will be found possible in the staff for running the machinery. This will no doubt become an important factor bearing upon the possibilities of employment among a body of men whose ranks have been swelled year by year to keep pace with the requirements of steamers afloat. Then, again, there is the basis of examination for official certificates, which must of necessity require revision to come into line with the new requirements. The Hamburg-American experiment will therefore be watched with the greatest interest by all concerned in maritime matters, and we feel sure everyone will join with us in congratulating the shipping company and the builders on the pluck they have exhibited in undertaking such an extensive and conclusive character of test.

NEW EXPRESS CUNARDER.

RECENTLY Mr. G. B. Hunter made a statement that the Cunard Company had determined to build the largest steamer yet constructed, but up to the present the proposed dimensions are not available. However, the new vessel is to be longer, broader and faster than the two liners *Olympic* and *Titanic*, now being built for the White Star Line by Messrs. Harland & Wolff, Ltd., at Belfast, and we believe she is to be larger even than the steamer now being built at Hamburg for the Hamburg-American Line. The two White Star vessels are each to be

850 feet long and 90 feet wide, so that the new vessel will probably be near the 1,000-feet length, which has been suggested in the past by Lord Pirrie as a possibility. As the growth of gigantic vessels increases one is led to wonder what steps will be taken to provide the necessary dock and other accommodation that the general requirements of such vessels will demand. In this connection the point may be considered as to the burden of cost of such increased facilities and on whose shoulders it should fall. There is no doubt that the ports which are administered on a broad policy will adopt the wise course of attracting custom by the investment of capital in improved and increased accommodation suitable for their patron's business. It may be said that if the facilities are not provided at one place then they will be at another, and we think this is a correct assumption. It may be suggested that the owners of large vessels should be charged higher rates, on the ground that, but for their abnormally large vessels, the enlarged accommodation would not be needed; but we do not think that this is either the commercial or the equitable way of dealing with the matter. It must be remembered that much attendant expenditure of money is involved over and above the dock dues and like expenses, and therefore it would seem a short-sighted policy to drive away customers who benefit, not only the dock-owners, but the community generally in the immediate neighbourhood, by penalizing them for their enterprise in catering for their customers.

THE UNIVERSITY OF LIVERPOOL.—We have received a copy of the prospectus setting forth the courses being inaugurated in connection with the University of Liverpool in the faculty of engineering, and we have pleasure in noting the prominent features of the naval architecture and marine engineering courses. The advice given to intending students is to remain at a secondary school till the age of seventeen, taking the matriculation examination meanwhile and devoting special attention to chemistry, physics and mathematics; to then serve an apprenticeship of three years, keeping up mathematics, applied mechanics and physics at evening classes, and complete with a three years' University course. The fee for the course is £37 per annum, and includes all the lectures and classes laid down for the course to be taken. There are several scholarships, one in connection with the Institution of Naval Architects of £50 per annum, tenable for three years; Sir Edward Harland scholarship of £80 per annum for two years, the Bibby, Bashell, Tate Trustees, Tate Technical, Pickup and Boyd of amounts ranging from £20 to £40 per annum, besides other local scholarships and special grants. It will thus be seen that the courses are intended to be of a high-class character and inducements are offered to those whose circumstances may not admit of them taking such courses without monetary assistance. The course for naval architecture is a most comprehensive one, dealing with the lines of a ship, strength of the structure and the material, stability, resistance and propulsion, and the drawing office work. The course for marine engineering is also an excellent one and is closely allied to that on naval architecture, including some of its features where these are of a character necessarily involved in the propelling efficiency of the machinery.

Captain Blyth.—We regret to record the death of Capt. Robt. Blyth, chairman of the Imperial Merchant Service Guild, who passed away suddenly at his residence on the 8th August.

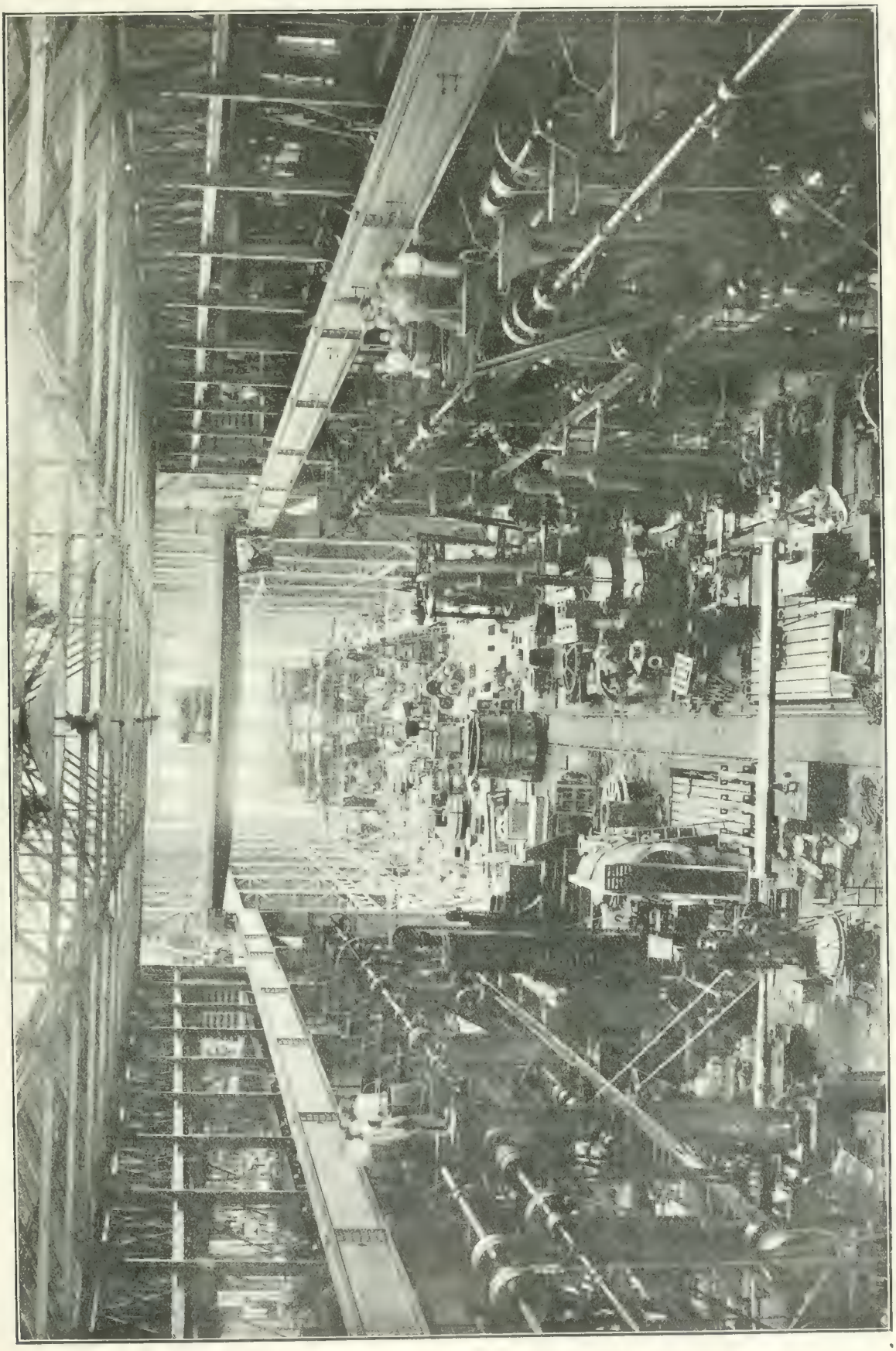
THE MITSU-BISHI DOCKYARD AND ENGINE WORKS.

THE Head Office of the Mitsu-Bishi Company is located at Tokyo, the capital of Japan, the President and Vice-President respectively being Barons Hisaya Iwasaki and Koyata Iwasaki. The illustrations we give show the enterprise which characterizes the management and the presiding genius of the Company, whose building-yards and engine-works at Nagasaki and Kobe are capable of undertaking work up to the most modern requirements. The photographs are reproduced by the courtesy of the President, who has forwarded the originals from Japan. This Company holds the licence for the manufacture of Parsons Turbines in Japan, China and Korea, and the illustration of the turbine workshop is evidence of how the licensees carry out their work.

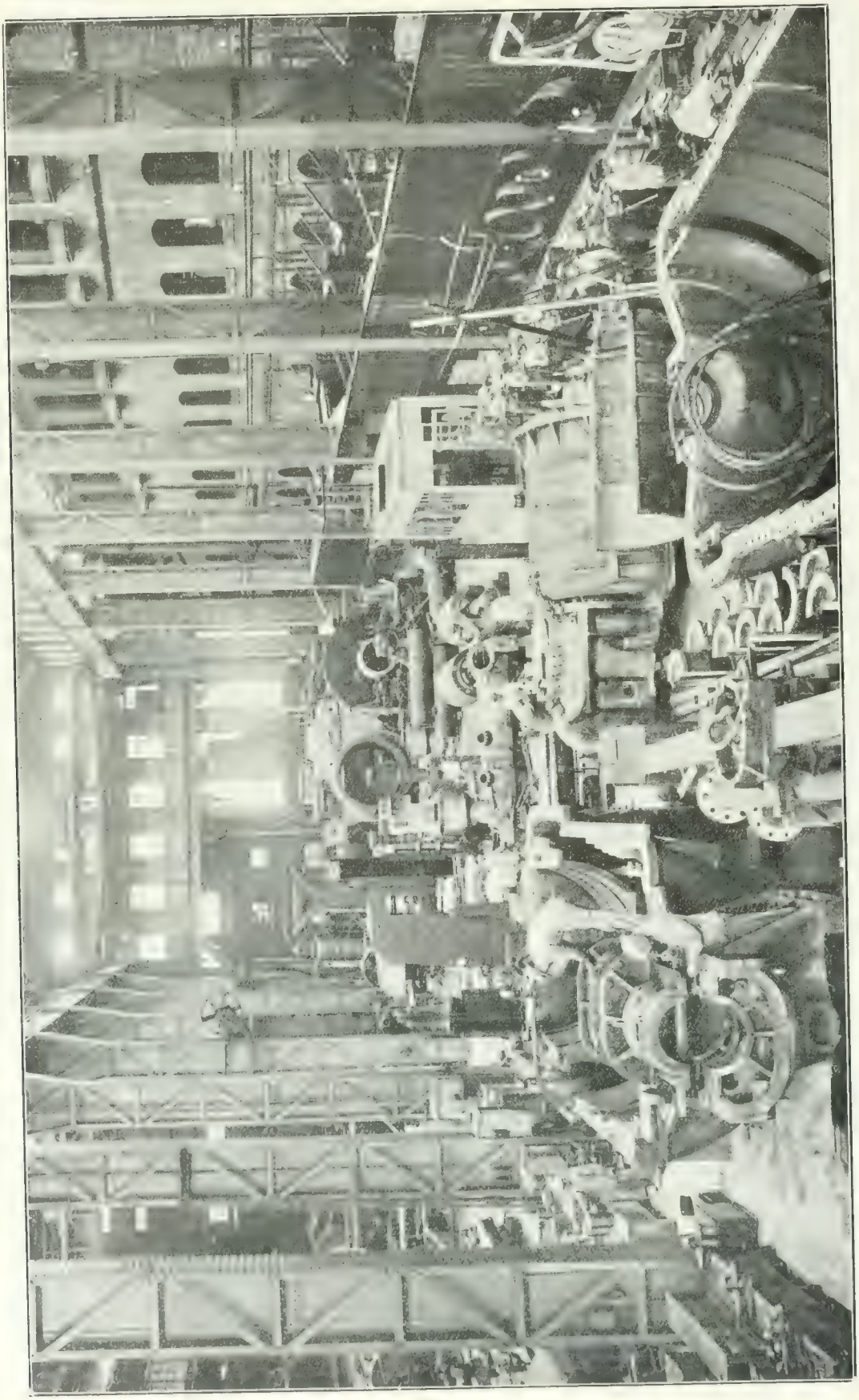
In one of the Japan sections of the Exhibition at Shepherd's Bush, adjoining the Machinery Hall, and among other exhibits of considerable interest and of educational value, the Mitsu-Bishi Company has a stand where is shown a full complete model of one of the largest steamers they have built, also raised models of the shipyard and works at Nagasaki. The commencement of engineering work at Nagasaki dates back to 1856, when, under the auspices of the Shogun Government, Dutch engineers were employed, the machinery necessary for the start being imported from Holland. Subsequently the engine-works were extended, when the Government of the country was reformed under the Mikado in 1868, and the Public Works Department took over the control. A large dry dock was then constructed; No. 1 dock, and a patent slip, hitherto carried on by private British enterprise, was bought over. The works were gradually developed and shipbuilding added in 1883, when the *Kosuge Maru*, a wooden steamer of 1,500 tons, was built. The following year the works and building yard, dry dock and slip were purchased by the Mitsu-Bishi Company. The first iron steamer, a small vessel of 206 tons, was constructed in 1887. Steel steamers with increased dimensions followed, and in 1895 the *Suma Maru*, of 1,592 tons, was built.

The war with China ended, in 1896, further developments were brought about, encouraged by Government regulations, and the Nippon Yusen Kaisha opened a line of steamers to Europe. The experience gained in building and engining small steamers was now brought to bear upon one of the 6,000 ton vessels ordered by this line. Six were constructed at this time, the one built by the Japan Company was completed in 1898. Since then the tonnage of steamers built in their yard has more than doubled. The turbine Trans-Pacific vessels, for example, built at Nagasaki, have been of 13,500 tons. The machinery and tools necessary to carry on work in the most economical and accurate way have been adopted, and obsolete machines discarded in favour of the most approved. It is also the aim and the practice of the Company to manufacture as far as possible all the details of ships and machinery within their own workshops, a course which involves a large capital outlay to cover specialized workshops and the equipment necessary to cope with the details of auxiliaries.

To such an extent has the group of buildings and plant grown that it is now one of the largest establishments in the East for shipbuilding and engineering work. It is interesting to observe the records showing the increase which has taken place during the last twelve years in the tonnage of the steamers built, and the indicated horse-power. In 1898, four steamers were built, amounting to 7,703 tons, with an I.H.P. of 4,225. The dry docks were employed to the extent of eighty-four vessels during the year, the tonnage being 254,069, while the slip was utilized by nineteen vessels of an aggregate tonnage of 3,539. During this year (1898) the average number of men employed per day was 3,430. In the year 1909 four steamers were also built, but the tonnage amounted to 29,596 and the I.H.P. to 33,379; the tonnage was thus nearly four times as much as twelve years previously, while the I.H.P. was increased by nearly eight times. The dry dock occupancy in 1909 was fifty-seven vessels of 148,102 tons, and the slip had thirteen vessels of 1,657 tons. The average number of workmen employed per day was 5,703, an increase of 2,273. The year 1906 shows the largest number of vessels and engines



Erecting and Machine Shop, 1910



Turbine Shop, 1910.

built in any one year during the twelve years, namely, thirteen, with a tonnage of 10,031 tons and I.H.P. of 22,735. The dry dock during the year had ninety-seven vessels of 385,758 tons, and the slip twenty-six vessels of a tonnage of 8,167 tons.

Nagasaki, well-known for many years as a coaling port, is situated on the coast line, near the entrance to the famed Inland Sea of Japan, through which steamers bound to and from Hiogo sometimes take their way. The banks of this sea are richly wooded down to the water's edge on either side, and the whole passage forms a very pleasant reminiscence in the memory of the traveller who has been favoured to witness the picturesque views lining the water-way. The inner harbour of Nagasaki is lined on its western shore by the workshops and offices of the Mitsu-Bishi Company, with

Tategami Shipyard, 1910.

a water frontage of about 8,000 feet, and an area of 114 acres. The appliances and machinery are of an up-to-date character for dealing with shipbuilding, engineering in all its phases, dry-docking and overhauling, including hydraulic, electric and pneumatic installations. There are seven ship-building berths, laid out for lengths of 240 feet to 700 feet, with the moulding lofts, plate and angle benders, plate machines, galvanizing and other workshops conveniently arranged on the adjacent ground. On the other side of the harbour from the shipyard is the patent slip, on which vessels of 1,000 tons gross can be taken up. Three dry docks adjoin the shipyard premises, the largest being sufficient for vessels 714 feet by 84 feet by 34 feet 6 inches draught. Next to these the engine-works stand replete with all the necessary machinery, gear and appliances for executing new or repair work on advantageous terms. The offices are comprised in a substantial building with ample accommodation for the management, supervisors, draughtsmen and clerical staff. The ship draughtsmen number 127 in full complement, and the Chief has also charge of the large fully-equipped experimental tank. The engine drawing office, including electrical, has accommodation for 125 draughtsmen. A mess room for the draughtsmen is provided. The draughtsmen engaged on Admiralty work, twenty-five ship and twenty-five engine, are provided with a separate drawing office, 84 feet by 31 feet in area. The telephone system is complete and embraces all the departments of the works, to minimise time and facilitate communication between the management and the various details.

The engines and boilers are shipped into the vessels, after launching, at the jetty by means of a large crane—by Messrs. Appleby, Limited—of 150-tons capacity, with a jib radius of 156 feet 6 inches, electrically driven. The operator is provided with a clear look-out to see the load at all stages, and has communication with the director of operations by means of speaking tubes and telephone. There is a floating lifting apparatus, consisting of sheer-legs of 30-tons capacity. The necessity which arises occasionally for salvage operations has been met by the inclusion of a salvage steamer, the *Oura Maru*, of 12 knots speed, specially built and equipped for the work, and fitted with one 18 ins. and three 12 ins. centrifugal pumps, one 8 ins. and one 6 ins. special pumps, with all the needful gear and outfit and men—including divers to cope with salvage work on short notice.

MODERN SHIPYARD MACHINERY AND EQUIPMENT.

VI.

(*Continued from page 6*)

Fitting-out Cranes.

In consequence of the increased beam of large modern twin, triple, and quadruple-screw steamers, and of the concurrent development in marine engineering, involving the handling of heavier and heavier pieces of machinery, there has been a decided development in large power cranes for fitting-out purposes within recent years. The increased adoption of cranes of increased power and outreach has, of course, been greatly contributed to, and rendered possible and satisfactory, by its association with the electric system of power. The large cylindrical boilers, the massive framing and bed-plates of reciprocating engines, and the casings and motors for powerful marine turbines, now often weigh anything between 100 and 150 tons. Very frequently marine boilers, for example, even without their fittings, exceed 100 or 110 tons in weight, and to place such items on their seats at the side of the ship furthest from the wharf, in ships of great beam especially, without having to turn the ship end-for-end at the crane wharf, has become a matter of the greatest difficulty with derrick cranes and sheer-legs of the older pattern and capacity. In the eighties and nineties sheer-legs were in many instances preferred to cranes, but only very few of these attained a lifting power of as much as 130 tons, with an outhang at the top of the legs of 57 ft. As the forelegs could be pivoted at the front edge of the wharf, this gave a sufficient overhang for most purposes, enabling the boiler to be placed almost on the offside of a vessel of 70 ft. beam. Now, however, the action of the sheer-legs is considered slow. This is especially the case in the tilting outwards of the top. The third leg is connected with a powerful screw shaft at its base. On the screw shaft there is a nut to which the base of the third leg is secured, so that the turning of the shaft causes the nut to traverse forward for the tilting of the top of the sheer-legs outward or backwards to bring them again to the vertical position. The speed of rotation of this shaft is, as may readily be understood, very slow; and apart altogether from this, there are other disadvantages when comparison is made with modern—and, may we say "fashionable"—cranes.

Rotating derrick cranes (at first steam and now electrically actuated) were the next best alternative, and had the imprimatur of long years of service. Modern examples of these cranes, as will afterwards appear, have been built of large powers up to as much as 130 tons, with a radius of 70 ft. By mounting a crane of this type very close to the edge of the wharf, Messrs. Scott's Shipbuilding and Engineering Co., as afterwards shown, is dealing with loads of 120 tons at the effective outreach of 63 ft. from the quay, which is adequate for most purposes. In the ordinary derrick type of crane the rotation of the jib is limited to only a part of the circle, and this represents a great advance on the sheer-legs, which cannot rotate at all. There is, however, a very material advantage in being able to raise the load from any position and to slew it through a complete circle, as with some examples of the modern type of jib crane; such, for instance, as that adopted by the Clyde Navigation Trust for lifting boilers, etc., on board vessels at Finnieston Quay and in Princes Dock. This crane, tested to 150 tons and working to 130 tons, is an admirable example of a jib crane revolving through a complete circle on a roller path on the quay. The crane in this instance has a jib with an extreme height above the quay level of 110 ft., and the centre of the jib-head pulleys for heavy loads is 100 ft. from the quay, so that here the overhang is greater than in the instances already noted.

Within the past two or three years what is now termed the cantilever or "hammer-head" crane has, in many instances, displaced both sheer-legs and derrick cranes, although in particular cases derrick cranes and even sheer-legs are adhered to and being renewed at the present time. An instance of this is the fitting of a set of 100-ton sheer-legs by Messrs. Day & Summers at Aberdeen for the Harbour Commissioners at that port. The earlier types of hammer-head cranes had their origin on the Continent, in German ports especially; and replicas of some of these have been installed in some large British shipbuilding establishments, *e.g.*, Messrs. Wm. Beardmore & Co.'s works, Dalmuir, on the Clyde, and in the works of Messrs. Vickers, Sons & Maxim, Barrow-in-Furness. These have proved satisfactory in solving the problem of handling the large weights now common, although, as will be shown, somewhat wanting in some respects in that solidity which is desiderated by British ideas in the interests of durability and low cost of maintenance.

Following upon the German model as to general appearance and action, but with decided improvements on the lines indicated, British crane makers have already installed numerous examples of this type of crane, giving entire satisfaction. We illustrate in fig. 1 a revolving electric cantilever or hammer-head crane of 160 tons capacity, designed by Messrs. Cowans, Sheldon & Co., Carlisle, and installed last year at H.M. Dockyard, Devonport. Owing to pressure of work in hand at the time the crane was ordered, this firm, after preparing the whole of the detail drawings for the tower and cantilever, sublet this part of the works to Messrs. Arrol's Bridge and Roof Co., Ltd., Glasgow (now Messrs. A. & J. Main & Co., Ltd.), the whole of the foundations having been prepared by the dockyard authorities. Nominally of 160 tons lifting capacity, this crane was tested in accordance with the usual Admiralty requirements with a load of 240 tons. It is constructed to lift its working load of 160 tons at 95 feet radius, 80 tons at 105 ft. radius, and 50 tons at 128 ft. radius. The main lifting gear consists of two independent pulleys of 80 tons capacity each, this arrangement being provided in accordance with Admiralty requirements to enable long guns and shafts to be angled when being passed through hatchways, etc. While the various weights can with higher lifts be worked at greater speeds, the following are typical, *viz.*:—The heavy lift (two blocks) lifts 160 tons at 6 ft. per minute, while with one block 80 tons can be lifted at same speed; the light lift takes up loads of 30 tons at a speed of 20 ft. per minute. With 160 tons load, the speed of traverse over the cantilever is 30 ft., and with 80 tons, 60 ft. per minute. As regards revolving motion, one revolution can be made with a load of 160 tons in eight minutes, with 80 tons in six minutes, and with no load in the same time. Each main block is carried on eight parts of $4\frac{3}{4}$ ins. circumference steel wire rope, which is sufficiently long to enable the blocks to be lowered 50 ft. below the quay level. Each rope is coiled in one layer on a turned and grooved cast-iron barrel, 6 ft. 6 in. in diameter by 10 ft. long. The main barrels are driven from the motor through three trains of steel machine-cut gearing. The light lift gear is of similar construction, but is arranged to lift the load in four parts of $4\frac{1}{4}$ ins. circumference steel wire rope, two parts being coiled on the barrel in right and left-hand coils. With the several motors fitted on the crane to work the various motions (which were all supplied by the British Westinghouse Electric and Manufacturing Co., Ltd., Manchester), and with the mechanical details of the traversing and other revolving motions and structural features there is not space to deal. It must suffice to say that the two cantilever girders are 220 ft. long by 28 ft. deep at the centre, and are fixed parallel to one another at 20 ft. centres. The trolley frame, built of steel, is mounted on four pairs of cast-steel rail wheels, the rail tracks being double, of 2 ft. 6 ins. gauge. The main machinery is enclosed in a sheet-steel house, situated at the short or butt-end of the cantilever or hammer-head, and a ballast-box, filled with 160 tons of ballast, is fitted between the girders underneath the machinery house. The roller bearers for the circular path are 46 ft. in diameter, there being seventy-two solid forged steel rollers. The house is 109 ft. high above ground level and 46 ft. square to the centre of the main columns, which are tied and cross-girdered securely as shown in the illustration. A feature of the crane worthy of notice is the arrangement and position of the operators' cabin, which, as will be seen, is fixed almost 25 ft. above the quay level, in order to bring the driver as close to the work as possible. The cabin is carried on a revolving steel frame, which is turned by the crane as it works.

Messrs. Sir Wm. Arrol & Co., within the past few years, have designed and fitted up somewhat similar cranes and

of a like power alongside the fitting out wharves of Messrs. John Brown & Co., Ltd., Clydebank; of the North-Eastern Engineering Co.; and of the Wallsend Shipping and Engineering Co., Wallsend-on-Tyne. Of the latter cranes we have already published an illustration and description.

At the present time the renowned Dalmarnock firm are busy on the final stages of erecting a mammoth electric crane of this type of no less than 200 tons lifting capacity (declared to be the most powerful in existence) alongside the fitting-out basin of the Fairfield Shipbuilding & Engineering Co., Govan. This "Titan" crane is situated on the east side of the basin, near the present sheer-legs, which will be dismantled by the crane when it is completed. The crane is carried on four large steel cylinders filled with cement concrete, and founded at a depth of about 74 ft. below the wharf level. The horizontal jib revolves upon a live ring of rollers on the top of a square tower. The height from high water to the rail level on the jib is 169 ft., and the horizontal jib has a total length of 270 ft., commanding an area of a circle 336 ft. in diameter. The operating machinery is placed on the tail end of the jib, so as to assist in counterbalancing the crane. The crane, electrically operated, as has been said, is controlled from a cabin situated on the front of the jib near the towers, where a clear view of the operations of lifting and lowering can be obtained.

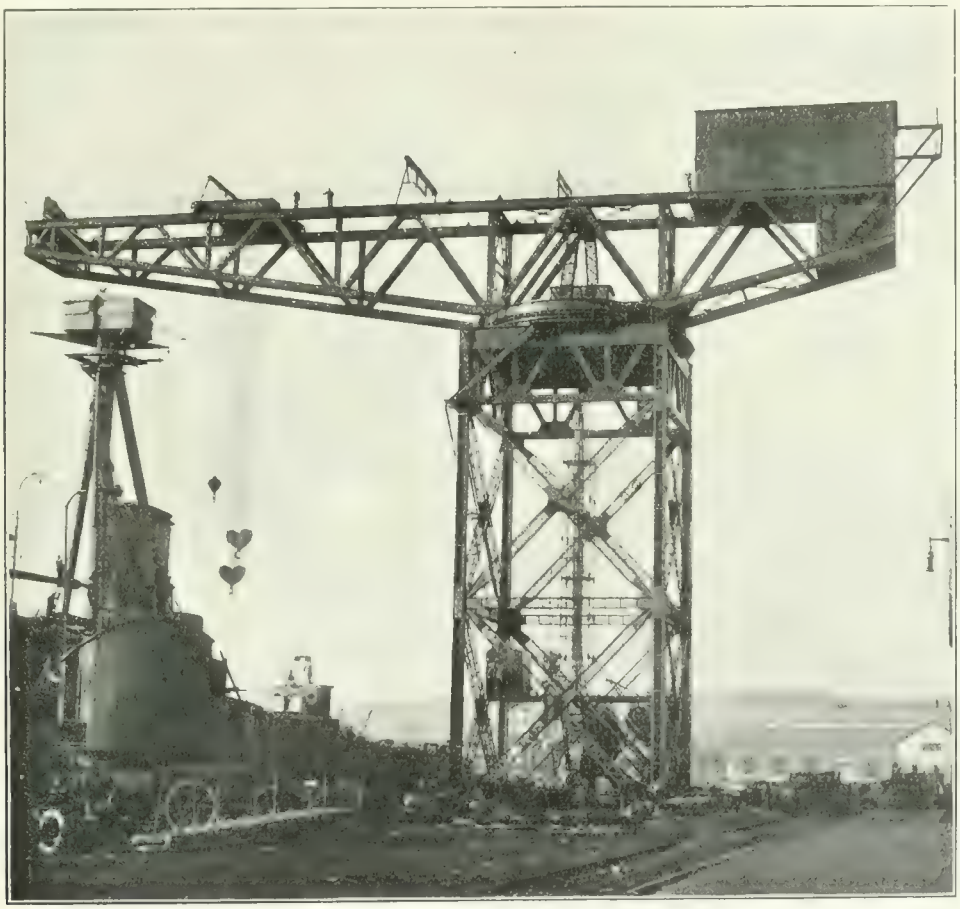


Fig. 1.—Revolving Cantilever Electric 160 ton Crane, by Messrs. Cowans, Sheldon & Co., Carlisle.

The Appleby Crane and Transporter Co., Ltd., Parkhead, Glasgow, have recently constructed for, and erected at, the Mitsu-Bishi Dockyard, Nagasaki, Japan, a hammer-head crane of 150 tons lifting capacity, which is electrically operated. It consists, like the cranes of this type erected by Messrs. Sir Wm. Arrol & Co., and Messrs. Cowans, Sheldon & Co. already referred to, of a four-sided tower erected on a masonry foundation upon a well piled area, having on the tower the horizontal slewing jib or hammer-head, which is tied in position by a centre pivot, and revolves on a roller-path secured to the top of the tower. The tower consists of four rectangular columns built up of steel plate and angle sections riveted together, and provided with horizontal and diagonal bracing on four sides. The jib is built of steel plates and angles riveted together. The load arm consists of two compound lattice-girders, connected together at the extreme end, and where they attach to the centre portion. The top members of each girder have two steel bridge rails at 4 ft. centres for the travelling trolley, and are connected together by bracings, while the lower members are also connected together by bracings; so that each girder is laterally stiffened to withstand wind pressure or buckling stresses. This mammoth crane, which was tested to the entire satisfaction of all concerned with a load of 180 tons, has a working capacity represented by a lift of 150 tons at 80 ft. radius on slow gear, a lift of 50 tons at 142 ft. radius on quick gear, and a lift of 20 tons at 142 ft. radius on auxiliary gear. The operating speeds are: Main hoist, 150 tons at 6 ft. per minute; main hoist, 50 tons at 18 ft. per minute; and auxiliary hoist, 20 tons at 25 ft. per minute. The speeds of the wracking and slewing motions are of corresponding efficiency.

While most of the firms who have within recent times, in substituting new appliances for old in the matter of cranes at their fitting-out basin, adopted the hammer-head type, there are some who have laid down instead of this type—indeed, in addition to it—derrick-jib cranes of the type which has so long approved itself in service. Messrs. John Brown & Co., about two years ago, in addition to

installing alongside their tidal basin the hammer-head 150-ton crane of Messrs. Sir Wm. Arrol & Co.'s make, also at the same time erected a derrick crane of the same capacity by Messrs. Cowans, Sheldon & Co. The former is erected on the west side of their tidal dock and the latter on the east side, and in this way they can deal with the heaviest loads for two ships simultaneously without moving the ships to and from the crane berth, as is done in other works, at considerable expense in time and money.

Messrs. Scott's Shipbuilding & Engineering Co., Greenock, considered the pros and cons of the several types some years ago, and erected, on the west wharf of their fine new fitting-out basin, a derrick-jib crane of 120 tons capacity, designed and supplied by Messrs. Geo. Russell & Co., Ltd., Motherwell. Of this fine appliance we give an illustration in fig. 2. Before giving particulars of this crane a few of the reasons may be stated as to why some shipbuilders and engineers still prefer cranes of this type.

In the original German type of hammer-head crane, the whole of the vertical load is concentrated at the bottom of the mast and must be distributed over the foundations by means of heavy girders; and there is considerable deflection due to the bending moments in the mast and the outer tower, as well as in the jib girder. Those defects are remedied in the British design; but on account of the large base required, the centre of the crane is seldom less than 30 ft. from the edge of the quay; and this distance must be deducted from the radius of the crane in considering its effective outreach. The derrick crane has the great advantage that its centre can be placed within 7 or 8 ft. of the edge of the quay. On account of the great height of the hammer crane, which is necessitated by the fact that it must be able to swing clear over all obstructions, the moment of wind forces on the structure is very great. With a wind pressure of 50 lbs. per square foot, the overturning moment may be as great as, if not greater than, that produced by the full load and even with no load on the crane; the combined effect when the wind acts in the same direction as the back balance weight may be excessive, rendering it advisable to have the crane turned round when such circumstances arise, so as to present the most favourable side to the wind. With the derrick crane, the structure does not require to be built to such a great height, as the jib can be raised when required to clear masts or funnels, and the centre of area for wind pressure as well as the centre of gravity of the whole crane is much lower.

The derrick crane, being of smaller dimensions and lighter, is also less costly. It is true the hammer-head crane has the advantage of slewing through a complete circle, and so is capable of covering a larger area than the ordinary derrick crane. It appears to us, however, that cranes, as in the case of the Clyde Trust cranes already referred to, and with a derricking jib placed on a comparatively low base might be so designed as to swing round the full circle and do all that the hammer-head crane can do. It could, at least, be built at a lower cost.

In the case of the Scott crane the centre is only 7 ft. from the front of the wharf, so that the full load of 120 tons can be dealt with at an effective outreach of 63 ft. from the quay. The maximum radius of the heavy purchase with a load of over 60 tons is 90 ft., and of the light purchase gear, with a load of 10 tons, 98 ft. The minimum radius of the crane is 25 ft. There are four sets of gear: for lifting heavy loads, for raising light weights, for derricking the jib, and for slewing; a separate controller of the enclosed tramway type is provided for each. The main hoisting and derricking motors are of 50 horse-power, and the others of 35 horse-power. The speed of hoisting 120 tons is 5 ft. per minute, while a 10-ton load is raised at the rate of 40 ft. per minute. Automatic brakes are fitted for the slewing motion, and powerful hand brakes for the hoisting and derricking gears. All motions are controlled by one man in the steel house fixed to the mast of the crane, 56 ft. above the quay level. There is, it may be added, on the opposite wharf of the dock a 20-ton travelling electric crane.

THE INSTITUTION OF CIVIL ENGINEERS.—The King has been graciously pleased to become Patron of The Institution of Civil Engineers, of which Institution he was an Honorary Member for seventeen years before his accession to the Throne.

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

Coincidences in Shipping Affairs.

IT has often been remarked how, in shipping matters at least, ships and names seem to have their waves of misfortune. The name "Standard" has recently been one of the unlucky ones. First there was the German tank steamer *Standard*, which, on the 30th June, 1,080 miles east of Sandy Hook, was in collision with the White Star passenger liner *Baltic*, bound from Liverpool to New York. The contact evidently narrowly escaped being a disaster, for the *Baltic* reached Sandy Hook with damage, fortunately above the water-line, and the *Standard*—though she proceeded on her voyage for Copenhagen *via* the west coast of Scotland and the Pentland Firth, and declined assistance from the passing steamship *Diamant*—suffered serious damage to her bows. Having reached Copenhagen in safety, the *Standard* was moored in the petroleum harbour to discharge her cargo and there, on the 19th July, she was on fire. The outbreak was sufficiently threatening to make it incumbent on the authorities to order the ships in her vicinity to shift from the port, and one vessel at least went away with but half her cargo on board. The harbour and military authorities took charge, and the Switzer Salvage Company's boats were in attendance. Fortunately, the energetic measures taken subdued the fire, though it was reported that the ship sustained serious damage, especially to her engines.

A week later there was opened at Cardiff the Board of Trade Inquiry into the circumstances attending the loss of the *British Standard*, a steamer of some 3,500 tons gross register, on her maiden voyage from Cardiff to Rio de Janeiro, with some 5,000 tons of coal. Off Negro Point, Brazil, in calm weather, she sank in some fifty fathoms. Her crew of twenty-six men included specimens of various nationalities, and serious allegations were made against the master in regard to his action before and after the disaster, as well as to alleged attempts by him to induce the members of the crew to make statements inspired by himself. The hearing was one of the longest on record, extending to no less than ten days. The master's explanation of the disaster was to the effect that the vessel must have run over some uncharted obstruction, whilst the Board of Trade and the representative of the underwriters commented on the improbability of the existence of any such danger in such a position as was indicated. Various circumstances, of minor importance in themselves, were brought to light, as, for instance, that fact that though he spelt his name differently, and though the fact of the relationship was unknown to the underwriters, the master was, in fact, the brother of the managing owner, with whom he had had somewhat extensive and complicated monetary transactions. Again, the cost of the vessel was £33,276. Of this a sum of £26,500 remained on mortgage with the builders. There were policies of insurance on ship, freight, disbursements and such-like amounting to £55,300. But, as counsel for the owners pointed out, if the suggestion aimed at was that the ship had been wilfully cast away, why should the owners have made out their insurance contracts for a year instead of for the single voyage? Moreover, though I do not know that the point was taken at the inquiry, over-insurance, or rather insurance for amounts beyond the actual value of the ship, is a recognised practice in the shipping world, and one which meets with the approval of underwriters themselves—since the higher declared value gives them a greater amount of cash as premium. The master's version of the circumstances surrounding the loss of the vessel seems to have had the support of the chief officer. The judgment was delivered on August 20th. The Court suspended the master and chief engineer for 18 and 12 months respectively, and the master was ordered to pay part costs of the enquiry. The Court found that due measures for the safety of the ship after the inrush of water, were not taken by these officers and that they made false statements to the Court. There is talk of an appeal.

Developments of Facilities

in communications with oversea possessions appear to be the order of the day. The new Royal Mail Line to Canada seems to have met with a measure of encouragement sufficient to embolden its managers to talk of the possibilities for a weekly service to Canada. The Clan, Harrison and Ellerman

lines have announced a joint weekly service to the East Coast of Africa, whilst the British India Company is in future to include Port Sudan in its itinerary. But the surprise of the day has been the announcement by the Union Castle Line that it is about to withdraw its new monthly service up the East Coast from Natal, and in its place inaugurate a new line of steamers making their way through the Mediterranean, the Suez Canal and the Red Sea to East African ports. Thus, like those of the German East African line, the mail steamers of the Union Castle Company will now circumnavigate Africa. So well had the secret been kept that, though everyone knew of it on the 12th August, no hint of what was coming was allowed to escape to the Company's guests on the trip round the Isle of Wight in the *Balmoral Castle* on the 5th August. Finally there is a new

coasts. It is announced that a scheme has been evolved by the Board of Trade in conjunction with the Admiralty, to provide watch huts on certain dangerous headlands round the coasts. These will be manned by coastguardsmen and will be in telephonic communication with coastguard and life-saving apparatus stations. The underlying idea of the scheme is to place these huts in positions which will command those dangerous spots which at present cannot be seen from the existing stations of the coastguard.

The Direct Service to Jamaica.

It will be remembered that the Imperial Direct Line to Jamaica was founded by the late Sir Alfred Jones to fulfil the requirements of the Colonial office, who were anxious to provide the inhabitants of Jamaica with a regular and steady means of sending their fruit to British markets. A

Fig. 2.—Derrick-Jib Crane, 120 tons capacity, at Scott's Shipbuilding Works, Greenock, by Messrs. George Russell & Co., Motherwell.

departure announced by Messrs. Alfred Holt & Co., of Liverpool. This firm has three vessels of some 10,000 tons a piece, building for its Australian trade. Besides a huge cargo—including, of course, refrigerated meat and produce—these will each provide superior accommodation for some three hundred passengers of the first class. No third or second-class passengers will be borne by them. The steamers, in fact, though of somewhat less tonnage than the *Suevic* and her sisters, will provide for Glasgow shippers the service which the White Star Company has with its Australian branch service for the last few years afforded to Liverpool and the Thames.

The Loss of the "Thistlemor"

has effected a change of the Board of Trade provision for the assistance of those who may hereafter be in peril off our

subsidy of some £40,000 a year for ten years was offered to and accepted by the contractors, and the necessary steamers to enable the service to be maintained were specially built. In view of the approach of the date at which the contract was renewable tenders were some time ago invited by the Government. Only one tender for the extended period was made, and it was sent in by the Direct Line itself. From a statement recently published on the authority of Sir Owen Philipps, now chairman of the Elder Dempster Company, which manages the affairs of the Direct Line, that tender has not been accepted, and accordingly, in the absence of some arrangement with the Government for their continued employment, the fleet will be withdrawn at the end of the current contract. It cannot, I suppose, be denied that a subsidy of £40,000 a year was a heavy price to pay. But

the period named was indeed a short time in which to make a profit out of the construction and working of vessels specially designed for a fast cargo and passenger service of this kind. Moreover, the withdrawal of the steamers will strike at the existence of the tourist industries which were being built up—to the great advantage of the colonists—as well to the benefit of the tourists themselves, and of those who conveyed them. The decision of the authorities is, therefore, much to be regretted, not only on account of those immediately concerned, but also because it is calculated to kill this tourist traffic, put back again the progress of the islands and to destroy one of the best means open to the general public of learning the much-needed lesson of how to think imperially, and of studying colonial problems on the spot.

The "Balmoral Castle."

As I have already remarked, the Union Castle Company invited a party of guests to inspect their new steamship *Balmoral Castle*, on the 5th August. The vessel in question is one of the four twin-screw steamships recently added to their fleet. Two of these, the *Grantully Castle* and the *Garth Castle* are placed on the intermediate service. The other pair are the largest and finest mail steamers yet constructed for the Company. Each is between thirteen and fourteen thousand tons gross register, thus marking a step in advance on their most recent predecessors, the *Kenilworth Castle* and the *Armadale Castle*. Like them, too, one sister comes from Belfast, having been constructed in the yard of Messrs. Harland & Wolff, whilst the other hails from the Fairfield yard. Of the latest pair it is the *Balmoral Castle* which comes from the Clyde, and she is additionally interesting from the fact that she is the ship which was selected, even before her completion, to take the then Prince and Princess of Wales to South Africa on the memorable occasion of the opening of the Union Parliament. The lamented death of King Edward and the accession of King George to the throne have made it impossible for him to make the journey. But in his stead is to go the Duke of Connaught. His Royal Highness will be accompanied by the Duchess and apparently the programme originally fixed for George, Prince of Wales, will be followed by those who are taking over the duty in this regard. The *Balmoral Castle* has already had an opportunity of showing herself to the general travelling public, as she has made two round voyages in the mail service before being taken off to be fitted out for her voyage. Following the precedent set in the case of King George's Australian tour in the Orient liner *Ophir*, the *Balmoral Castle* will, whilst on this special service be commissioned as a King's ship, and will be manned and officered by naval men. But in one important respect there will be a change. In the case of the *Ophir* the engine-room staff was retained, a naval engineer being simply added in a sort of advisory capacity. The *Balmoral Castle's* engineers will, however, be withdrawn for the voyage, their place being taken by naval engineers and subordinate naval ratings.

It seemed impossible when one inspected ten or eleven years ago the *Kinfauns Castle*—first of the twin-screw mail steamers of the line—that the Castle Company would be able to improve on the scheme of decoration of that vessel. The smoke-room, with its fumed oak and antique tiles, representing as it did an old Dutch interior, seemed the last word in artistics—if one may coin a word. But improvement has been achieved nevertheless, and even in the smoke-room the *Balmoral Castle* is more taking than her predecessors. The omnibus roof of the older ships has in this case been supplanted by a lofty arch which affords a sense of air and lightness, whilst great comfort and a relief from a sense of crowding is attained by the provision of many alcoves. Moreover, the lounge adjoins, and thus it may be said there is a double smoke-room—one for men only, and the other for those who prefer gentler society whilst they enjoy their creature comforts. The second and third-class accommodation in the ship is particularly fine, and one notices with astonishment the large square windows which seem everywhere provided—save, of course, where the actual skin of the ship has to be pierced. Air and light are indeed the great features of the vessel, her main saloon having a large circular dome very much after the plan adopted in the great Cunarders. *Suites de luxe* on the most approved plan are also provided. Amongst the appliances fitted are included a powerful installation of wireless telegraphy, which, during the trip round the Isle of Wight, was kept incessantly busy by the Company's guests till dinner time, when advantage was taken of the diversion of their activities to receive the latest news of the world *via* the Marconi station at Poldhu, and to print it for our information in the journal which is produced in the steamer's printing office.

This wireless installation will, of course, be useful for communication with the escort of warships whilst the *Balmoral Castle* flies the White Ensign. But it will also be found of value when she returns to her regular trade, for Marconi stations are multiplying down the Cape route, and already the port of Durban is enabled to communicate with ships fitted with wireless—H.M.S. *Hermes* during the last few days having reported the safety of a distressed ship which she had assisted off the coast. It may be agreed that the *Balmoral Castle* and her sisters are convincing proof, if that were needed, that Sir F. J. Mirrielees and his co-directors believe in South Africa and mean to be more than ready for the good time they foresee in the near future.

Seamen and their Food.

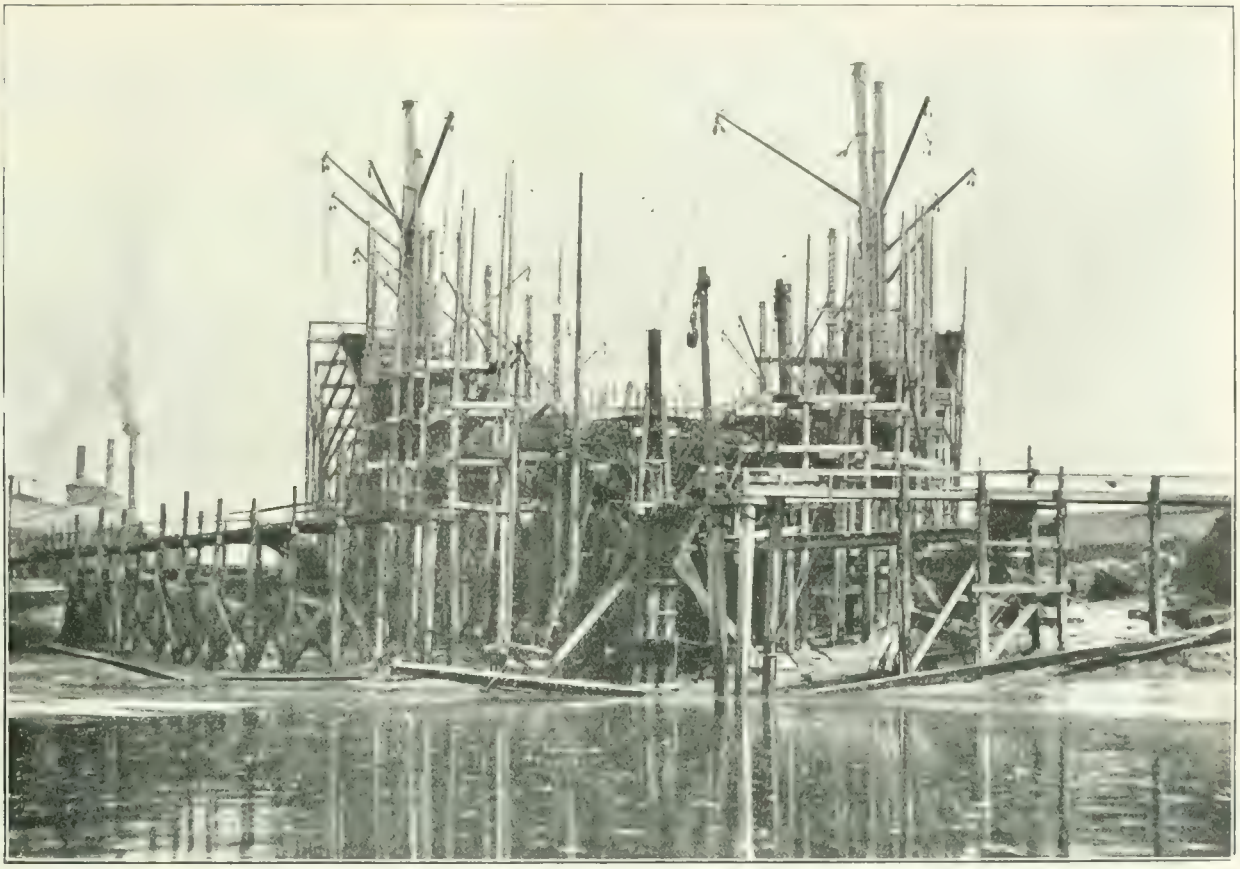
The New Zealand Shipping Company has raised rather a difficult point in regard to the rights of its seamen in respect of their rations under the Merchant Shipping Act. As is probably well known to all our readers a food-scale is set out in one of the schedules to the Merchant Shipping Act, and by law the shipowner is compelled to give his crew the articles and quantities there enumerated. This is, of course, a minimum. Shipowners who consider their men are at liberty to give them larger quantities if they so desire it. Now it appears that seven men, members of the crew of the New Zealand Shipping Company's steamship *Ruahine*, were found to be taking away from the ship tins of jam and marmalade. A prosecution at the West Ham Police Court followed. The men defended themselves from the charge of wrongful appropriation by the statement that the food was really their own, it having been served out by the ship for their use and not consumed by them, as it might have been. The magistrate before whom the case was tried came to the conclusion that the men had done that which they had no right to do, and he was of opinion that surplus food was still the property of the owners. He accordingly committed one of the defendents for trial in order that the question might be finally decided. Affecting as it may do, the position of large numbers of persons who are borne on ship's articles, it seems very desirable that the respective rights of shipowners and seamen in this matter should be ascertained and made known throughout the service.

THE NEW DREADNOUGHT, "THUNDERER."

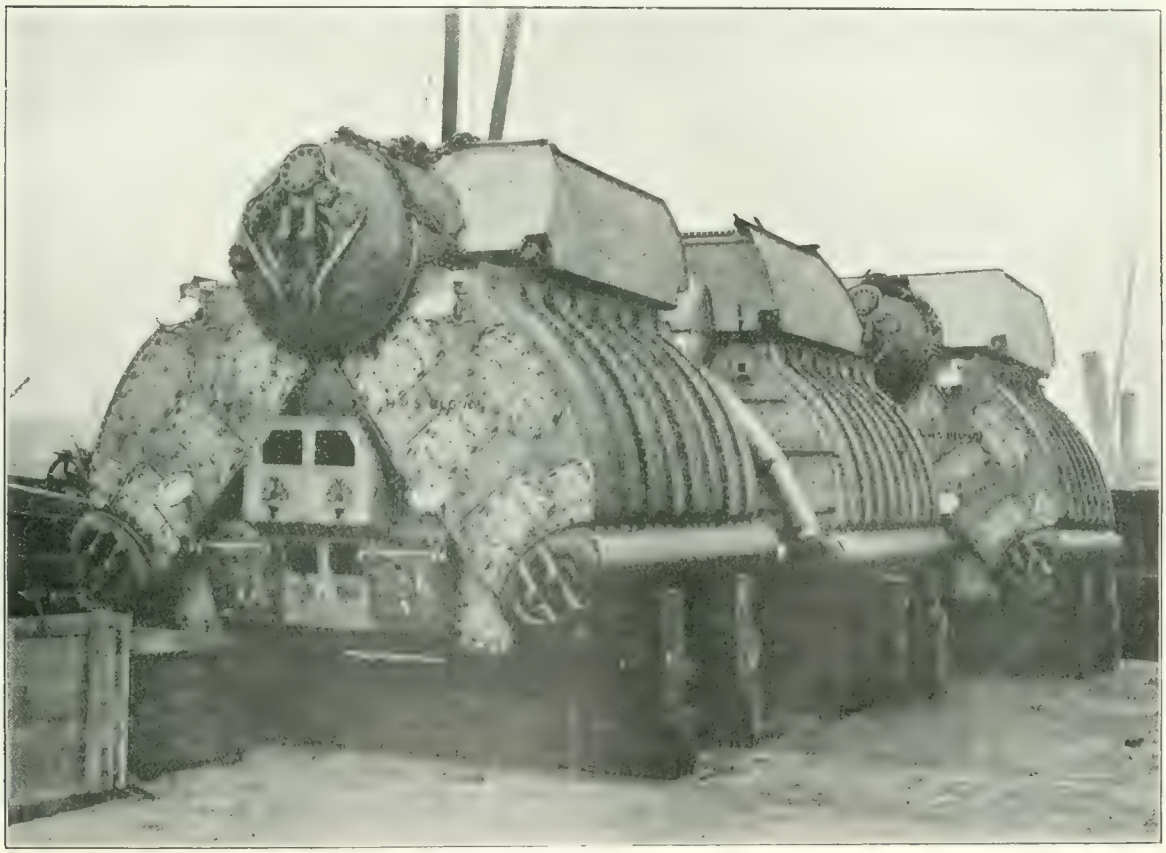
OUR illustration of the building of the first-class battleship *Thunderer* shows her as she appears from the Thames. The keel-plate was laid in the yard of the Thames Ironworks, Shipbuilding and Engineering Co., Ltd., on April 13th. In two years from that date she will be completed, and will have cost about £1,750,000. She will be 545 feet long, will displace 22,500 tons and will travel at 21 knots per hour. She will carry ten 12-inch guns, which will fire an 850-lb. shell through 20-inch armour at 3,000 yards, and 2,000 men are engaged upon her. Work is proceeding day and night. Every effort will be made to have her ready for launching in December this year.

The Thames Ironworks Co. have constructed about 900 vessels for the British Admiralty, foreign Governments and the Mercantile Marine.

The illustration opposite shows Yarrow boilers for H.M. unprotected cruiser *Blonde*, of 3,350 tons, building at Pembroke. The propelling machinery consists of Parsons turbines and Yarrow boilers to develop 18,000 I.H.P., and is being fitted by Messrs. Cammell, Laird & Co. Her estimated speed is 25 knots. She was recently launched.



The Building of the *Thunderer*.



Yarrow Boilers for H.M.S. *Blonde*.

THE NEW CUNARD LINER 'FRANCONIA.'

WE are able to present to our readers some illustrations of the *Franconia*, which was successfully launched at the Wallsend shipyard of Messrs. Swan, Hunter & Wigham Richardson, on July 23rd. This Company, besides being responsible for the famous *Mauretania*, have also built for the Cunard Company the *Altonia*, *Ivernia* and *Carpathia*. The *Franconia* will be engined by the Wallsend Slipway and Engineering Company, and is the seventh vessel which it has engined for the Cunard Company.

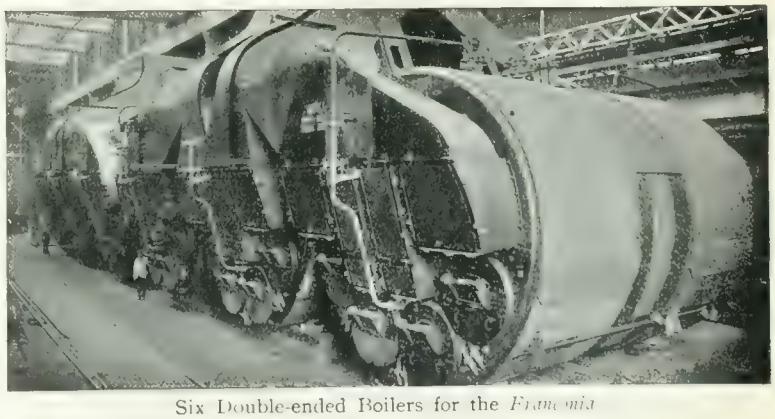
Though not so large in point of gross tonnage nor built with the object of attaining the unrivalled speed of the express Cunarders *Lusitania* and *Mauretania*, yet the *Franconia* will embody many features — especially in regard to her passenger accommodation—that will place her in the very front rank of modern liners. She will be primarily attached to the Boston service, now being carried on by the *Ivernia* and *Saxonia*, and is larger and faster than either of the two latter boats; in fact, she will be the largest boat to enter Boston harbour. During the winter season she will be attached to the Cunard fleet cruising between New York and the Mediterranean.

A digression may be allowed here in order to allude to early associations of Boston with the history of the Cunard Company. Just seventy years ago—in 1840—the Cunard Company, then formally entitled "The British and North American Royal Mail Steam Packet Company," started a regular line of steamers between Liverpool and Boston. The first four steamships of the Company were the *Britannia*, *Acadia*, *Caledonia* and *Columbia*, all wooden paddle wheel vessels with ordinary side lever engines. The *Britannia*, which was the pioneer boat of the fleet, measured 207 ft. long × 34 ft. 4 ins. broad, × 22 ft. 6 ins. deep, with a tonnage burden of 1154, and an indicated horse power of 740. Her cargo capacity was 225 tons, and she was fitted for the accommodation of 115 cabin passengers, but no steerage. Her average speed was 8½ knots per hour, on a coal consumption of 38 tons per day. The inauguration of the mail service took place when the *Britannia* sailed upon her maiden voyage from Liverpool on Friday, 4th July, 1840, the "Celebration Day" of American Independence, and she arrived safely at Boston, after what was then considered a rapid passage of 14 days 8 hours, and experienced an unprecedented ovation from the inhabitants. To testify their full appreciation of the benefits to be derived by the establishment of the new service the citizens of Boston celebrated the occasion with a magnificent public banquet, at which their enthusiasm found vent in speeches of the most complimentary nature. And, later on, these same merchants gave practical proof that the goodwill expressed at this time was not of that evanescent character which is sometimes produced under the influence of mere excitement, for when the *Britannia* was ice-bound in Boston Harbour, in February, 1844, they liberated her by cutting a canal through the ice, seven miles long and 100 feet wide, at their own expense. Thus auspiciously inaugurated, the regular service has been maintained ever since.

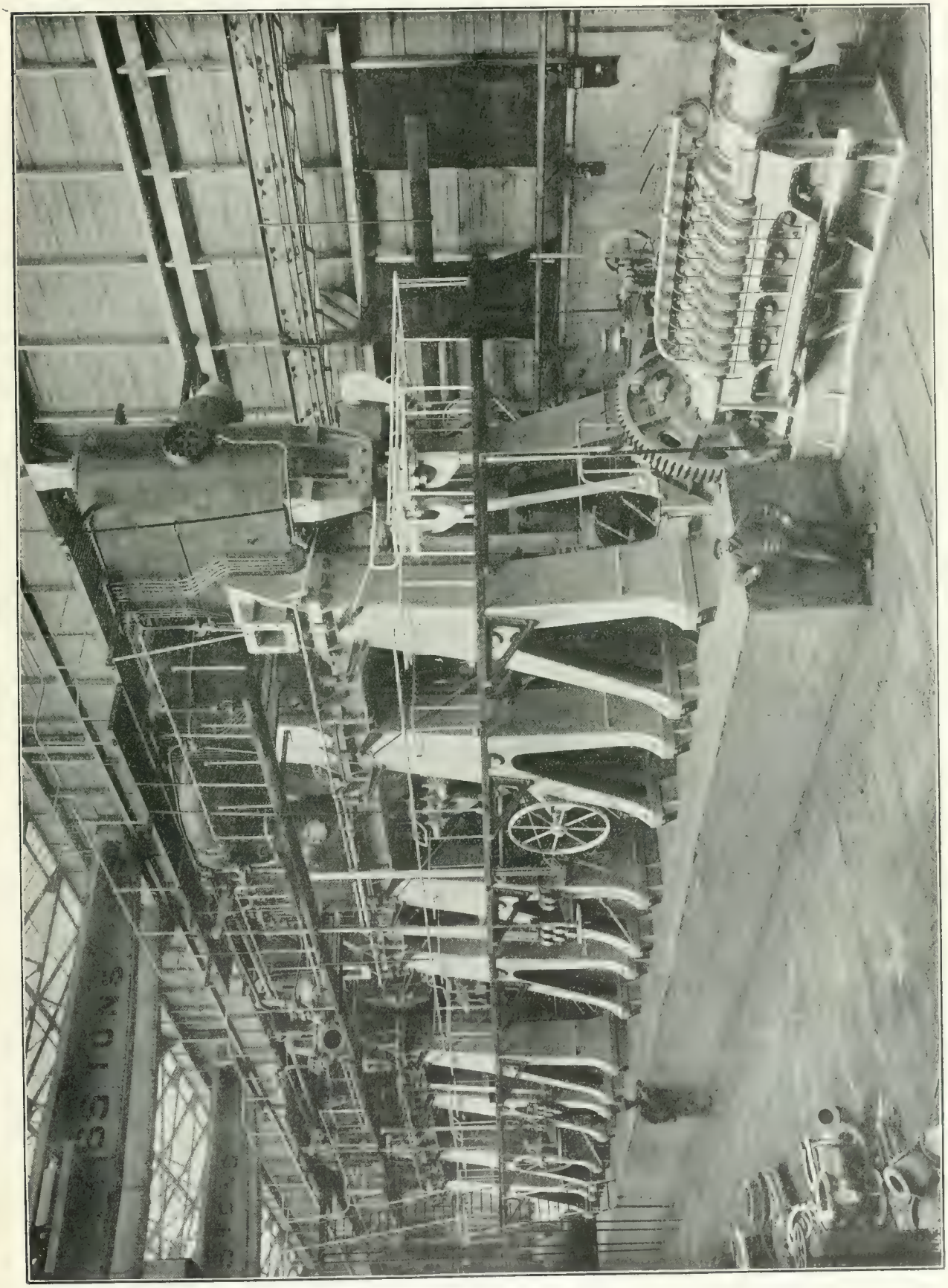
The principal dimensions of the *Franconia* are:— Length over all, 625 feet; breadth over all, 72 feet; depth from top of houses to keel, 90 ft.; draught, 29 ft. 6 ins.; gross tonnage, 18,000 tons; displacement, 25,000 tons; height of funnels, 140 feet above lowest furnace bars; diameter of funnels, 17 feet 6 inches; height of masts, 200 feet above the keel.

The propelling machinery will consist of twin-screw

Stern view of the *Franconia* prior to launch.



Six Double-ended Boilers for the *Franconia*



Engines of the "Franconia."

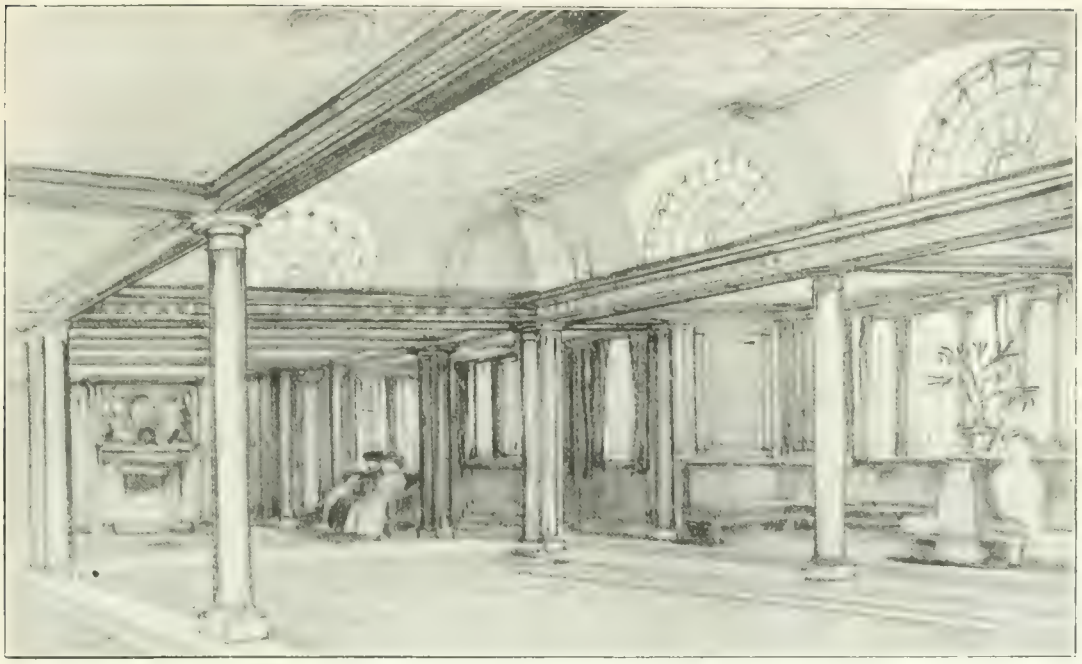
engines of the inverted, direct-acting, quadruple-expansion type, balanced on the Yarrow, Schlick and Tweedy system, having four cranks to each set. There will be four cylinders to each set of engines, namely, one H.P., one 1st M.P., one 2nd M.P. and one L.P., approximately the diameters will be as follows:—33in., 47in., 67in. and 95in. respectively, with a stroke of 60in. The total indicated horse power will be about 14,000, and the vessel will have a speed of 18 knots. There will be two manganese bronze four-bladed propellers and several double-ended boilers, with eight furnaces in each boiler. The weight of each boiler with mountings, etc., and full of water, will be about 215 tons. An efficient system of mechanical and natural ventilation will be provided in the engine and boiler rooms, consisting of a large number of electrically driven fans, each capable of delivering 800 cubic feet of air per minute. The stokeholds are large and airy, precaution having been taken for the provision of fresh air to all parts. A suitable workshop will be provided for the engineers, with a large lathe and a universal drilling machine. Two atmospheric silent hoists are to be fitted in each of the boiler-rooms, also a Stone ash expeller. Provision has been made for carrying about 1,500 tons of fresh water on board, and, in addition, two distillers are to be installed, which will produce 90 tons of pure drinking water per day if necessary.

The *Franconia* has been designed on the graceful lines for which the Cunard boats are noted, at the same time embodying all those features necessary to ensure steadiness and seaworthiness in all kinds of weather. In all, there will be no less than seven steel decks. She is fitted with bilge keels for resisting rolling when in a seaway. Water-tight transverse bulkheads divide the ship into a number of water-tight compartments, thus securing, as far as possible, her unsinkability should the bottom by any means be pierced. Extensive passenger accommodation will be provided and the scheme of decoration is refined. The period adopted by the architects, Messrs. Willink and Thicknesse, of Liverpool, is that of the time when the American Settlements were Colonies of Great Britain, and the style that is known in America as "Colonial" and in this country as "Georgian." The dignity and effectiveness of this style will be strikingly portrayed in the treatment of the main dining saloon situated on "C" deck. Here will be provided two, four, six and eight-seated tables, an arrangement much appreciated by passengers, while an unique feature of the planning of this room will be the provision of loose four-legged chairs in place of the usual fixed revolving seats. A balcony with a tastefully designed wrought-iron balustrading will overlook the saloon, and above will be an elegantly decorated ceiling. A bandstand for one of the famous string orchestras provided on all Cunard liners will be situated at the after end of the balcony. Forward on the starboard side of the "C" deck will be the children's dining saloon, appropriately furnished and fitted with small tables, while abaft the main saloon will be the kitchens and sculleries complete with the most up-to-date culinary appliances. On the "A," or "Boat" deck, will be situated the public rooms other than the dining saloons. The smoking room will be a most comfortable apartment. The panelling of the walls with Harewood of a soft pearl grey shade, will be relieved by inlays of Kingwood, while lounges of the most comfortable description will be arranged round the room. A table will be placed in each bay, and quite a new and happy idea is the construction of an elliptical retreat at the after-end, enabling passengers to obtain an uninterrupted sea view over the stern of the vessel. Adjoining the smoking room will be the verandah café. The lounge will be situated in the centre of the boat near the grand entrance, and will be a large and handsome room. Close by will be a daintily arranged writing room and the library. With the exception of the purser's office, ladies' and gentlemen's hairdressing saloons, and the nurse's and typist's rooms, the whole of "B" deck will be devoted to *en suite* rooms and first-class cabins. There will be four sets of the former, each consisting of a drawing room, bedroom, bathroom and other conveniences. The state-rooms, of which there are to be a large number, will be spacious apartments, and fitted to meet every requirement in the way of comfort and convenience. Each has accommodation for two passengers, for both of whom lower berths are provided.

Equal care and thought has been devoted to the arrangement of the second-class accommodation on "C" and "D" decks. The dining saloon, modelled somewhat on the lines of the first-class, will have seating accommodation for 300. In the large smoke-room, panelled in Circassian walnut, will be comfortable settees and easy chairs. Adjoining will be a tastefully arranged drawing or ladies' room. The accommodation for the third-class passengers will be provided in the forward part of "C" and "D" decks. There is to be an open and covered-in promenade, a large and well-appointed dining hall, in addition to other public rooms. It will be electrically lighted throughout, and the sleeping apartments will be spacious and airy. On the "E" or upper deck third-class and crew spaces will be provided, and the "F" or main deck is to be fitted out for third-class with two large dining saloons. The "G" or lower deck will be arranged at the forward end for third-class, while the aft will be utilized for the ship's provision stores, mail and baggage rooms. The arrangement of the kitchens and sculleries will be in keeping with the advancement characteristic of the equipment and fittings of the new liner. There will be the very latest types of refrigerating plant, and some idea of the care to be taken that the meat, fruit, fish, wines and other items of table diet should be served as on shore, may be gathered from the fact that each is to be stored in its own separate compartment, where the temperature is regulated to suit the particular commodity.

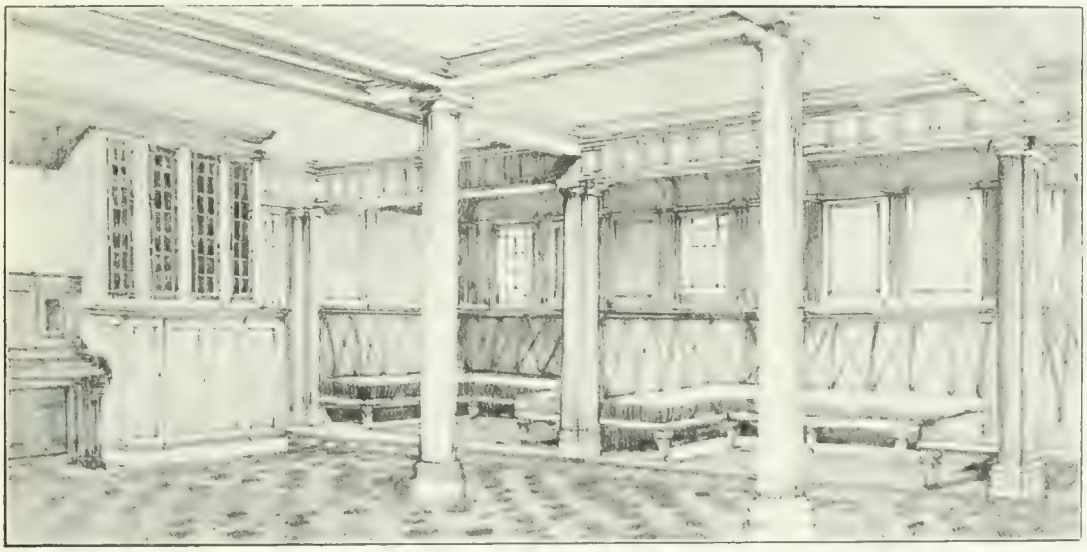
The *Franconia* will be equipped with the Marconi wireless system and submarine signalling apparatus. Electric lighting will be installed by Messrs. W. & C. Martin, Ltd., of Glasgow, and there will be a powerful searchlight and telephones for communication between the captain, chief officers, engineers and others. When complete and ready to start on her first voyage early next year, the *Franconia* will have been constructed and fitted out in something like record time. It is expected that she will be finished in little more than fifteen months, counting from the time when the keel plates were laid.

MESSRS. WAILES, DOVE & CO., LTD., have applied their "Bitumastic" enamel to the bunkers and cellular double bottom under engines and boilers, etc., and their "Bitumastic" covering to tank tops in engine and boiler rooms, refrigerating rooms and bunkers.

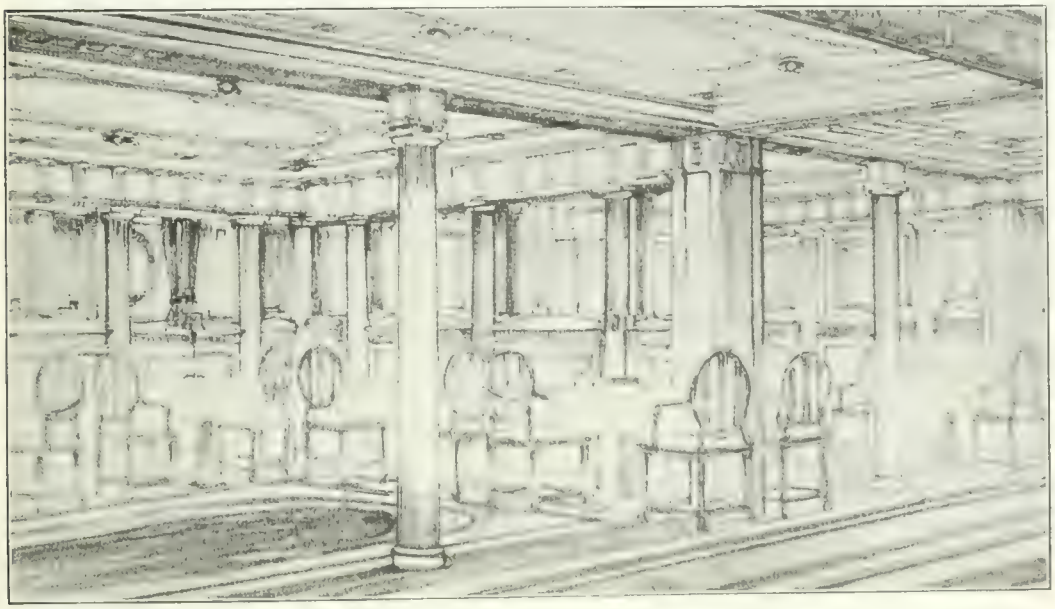


T.S.S. Franconia.

1st Class Lounge.



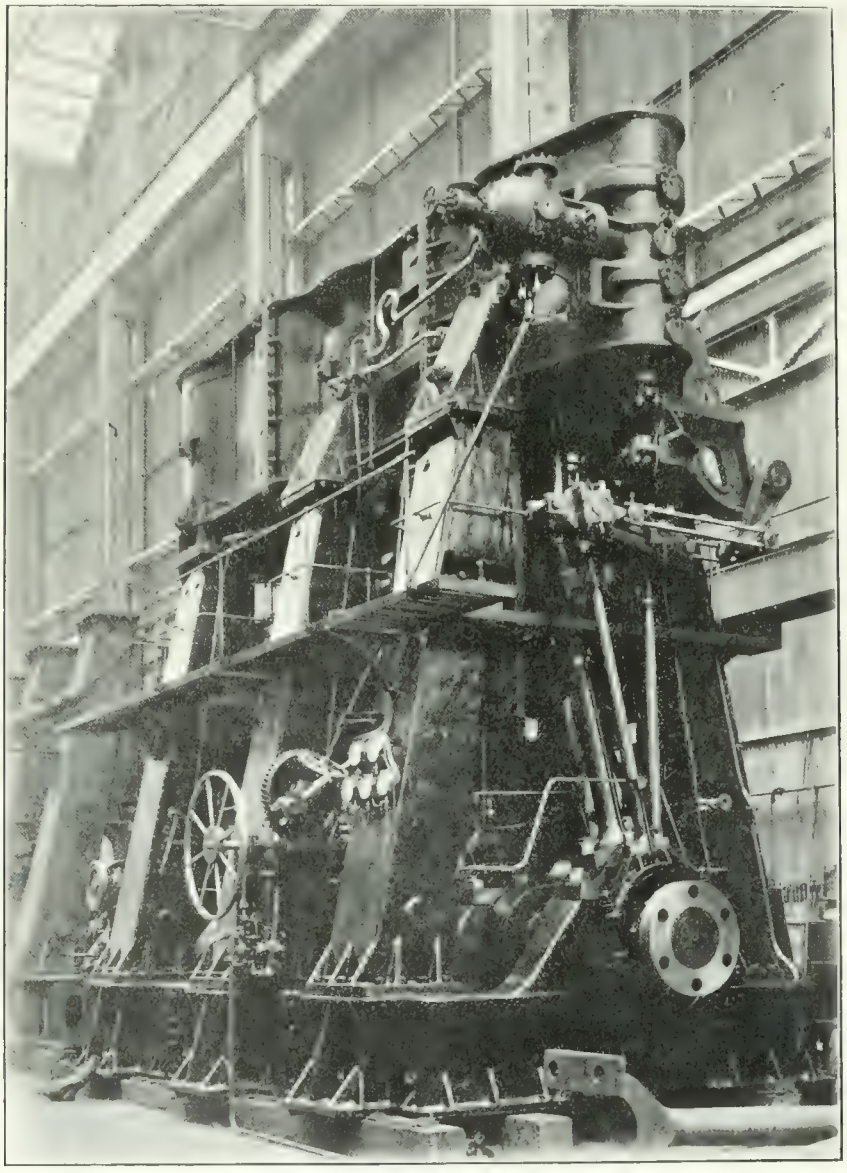
2nd Class Drawing Room.



Saloon.

ENGINES OF THE NEW NELSON LINE STEAMERS.

These engines are of the Inverted Triple-Expansion 3-crank type. The cylinders are H.P. 31″, I.P. 51″ L.P. 86″ dia. respectively, with 54″ stroke. They are fitted with a piston valve in the H.P., Andrews & Cameron's balanced slide valve in the I.P., and a double ported slide valve in the L.P. The reversing engine is of the all-round type, the Edwards air pump, two Bilge Sanitary and F.W. pumps being driven off the L.P. engine. The engines are being supplied to the four Nelson Line steamers by Messrs. Cammell, Laird & Co. About 4,500 I.H.P. is developed with 75 revolutions. Separate main condensers of the Quiggin type are fitted. These are expected to give a sea speed of 13 knots.



Type of Engines for Nelson Line Steamers.

A CHIEF ENGINEER'S CABIN OF TO-DAY.

During the last twenty years, the many additions made to, and the improvements in, recording instruments, have been noted in our pages from time to time; while suggestions have also in recent years been put forward in the course of discussions at the Technical Societies, advocating the establishment of an instrument room adjoining the chief engineer's cabin, where records may be kept and observations taken of the running conditions of all the vital details in connection with the machinery.

We reproduce herewith the photograph of a chief engineer's cabin, which shows several instruments installed on the bulkhead, neatly fitted to appear not too obtrusive, but as ornamental as may be, to avoid

the nightmare of constant shop to the eye of the cabin dweller. In the corner above the bed is a switch-board on which is placed a pilot lamp, with controlling switch; a fuse box; a telephone to the captain and to the pantry (no doubt this is suggestive of several incidental thoughts, constructive and destructive); switch for motor to drive a small lathe fitted in the cabin; switch for electric heated kettle, giving independence from boots; switch turn over for the telephone; a bell push to mess room and pantry and a switch for ventilating fan. Adjoining the switch-board is the speaking tube to the engine room, and a standard thermometer for testing the working set; a gauge showing the fan pressure in the stokehold for the forced draught steam-pressure gauge, small and finely graded and well made, to show correct reading of pressure on the main boilers; recording instrument for indicator paper to show the diagram of each twelve hours' work in fluctuations of boiler pressure; the air pressure for forced draught and the movements of the door into the ship's use provision chamber, a necessary record found useful in many cases where the attendant does not realize what the frequent opening of a door into a frozen-meat chamber means to the machinery and those in charge of it; a hydroscope for testing the humidity of the air, a useful instrument when chilled meat is carried at a critical temperature; an instrument for showing the temperature with percentage of moisture, critical point of moisture deposit and weight of moisture in the atmosphere, etc. There are other instruments which would be valuable additions to those enumerated as fitted in the cabin, which is illustrated by the kind permission of the occupier, but an office would be required added to the cabin to contain them. The case before us is unique and worthy of notice, so much so that we compliment the chief engineer on his ingenuity and taste.

Interior of a Chief Engineer's Cabin.

THE GRILLE WATER-TUBE BOILER.

A DESCRIPTIVE illustrated article on this boiler appeared in our last issue, and we would now add that, for the benefit of those interested in steam generators, demonstrations under working conditions—one of which we have witnessed—are being carried out periodically at the works of Fraser and Fraser, Bromley, E., to show that the Grille boiler is not only a good steam generator, but a safe one to work with in the event of a tube bursting, thus blowing steam and water into the fire-box, whether with the fire in full blast or with the damper closed. The Solignac cartridge inserted in each of the tubes at the water inlet is equivalent to a reducing nozzle; the flow of water is thus reduced proportionately to the area of heating surface in the tube, and is conducive to rapid evaporation, while in the event of a tube bursting, the outflow of water is minimized. The sectional arrangement of the tubes is worthy of note.

MARINE ENGINEERS' CERTIFICATES.

REFERRING to the articles which appeared in our July issue on this subject, we have now been favoured with the reply given by The Institute of Marine Engineers to the proposal now under the consideration of the Board of Trade to extend the sea experience of marine engineers, prior to examination for second and chief engineers' certificates respectively, to periods of eighteen months. The Council of the Institute is in accord with the views expressed in the articles referred to, and as the questions at issue deeply concern the ship-owning and engineering communities, and what concerns them affects the nation as a whole, we would call attention to the correspondence published in the August issue of the Transactions of the Institute, the more so as the correspondence with the educational authority appears to throw light on the later development. We endorse in the main, the views expressed by the Council of the Institute as to the technical theoretical service and there seems no doubt but that the present method of dealing with the workshop service alternative of technical college service requires definitely defining for the guidance of candidates and those who have to exercise jurisdiction over them, and the examinations which they require to pass. The object and intention of the Board of Trade are evident and clear in respect to the class of technical training necessary both as to workshop practice and theoretical training which may be considered suitable as a two-third alternative to the workshop. The specification of the type of technical college with a laboratory is also clear, but what appears to be wanting is a detailed definition of the minimum course which may be accepted, setting forth the subjects on which pass certificates must be produced, including a laboratory course. The aim of the training, both practical and theoretical, is to equip young men for carrying out their duties as engineers faithfully and diligently with an eye to economy. The laboratory course is certainly useful to the engineer and ought to make him a more valuable servant to his employers, a desideratum most earnestly to be looked for on economic and national grounds.

THE "MARATAH" ENQUIRY.—We understand that the greater part of the evidence has been collected, but it is expected that some time will elapse before the case is complete.

DAMATENE CO., LTD.—This Company is issuing entirely new catalogues, and all previous price lists are cancelled. Engineers are requested to apply for the new lists.

MESSRS. COCHRAN & CO., ANNAN, LTD., have supplied to each the s.s.'s *Malaespera* and *Ilheos* their donkey boiler, fitted with patent seamless furnace. To the floating dock, *Araujo Rinho* they have supplied two boilers and furnaces.

LECTURES ON LAW RELATING TO ENGINEERING.—The Council of the Junior Institution of Engineers (Incorporated in conjunction with the Council of the Society of Engineers (Incorporated), have arranged for a course of six fortnightly Lectures on "The Law relating to Engineering," to be delivered by Mr. L. W. J. Costello, M.A., LL.B. (Cantab.), the first to be given on the 10th October next.

Marine Engineer and Naval Architect.—We shall be pleased to see visitors at our stands Nos. 31 and 58 at Olympia, during the run of the Naval, Mercantile Marine and Engineering Exhibition from the 1st to 26th September, where we shall be pleased to give any information or assistance in our power, and where literature on naval and mercantile marine affairs may be had.

H.M.S "LION," THE WORLD'S RECORD CRUISER.

Our Fifteenth "Dreadnought."

THE battleship-cruiser *Lion* was launched by Viscountess Clifden at Devonport on August 8th, in the presence of a vast concourse of people. The ship has been built under the supreme direction of Vice-Admiral C. H. Cross, the constructive work being carried out under Mr. A. E. Richards, manager, assisted by Messrs. Milton, Ottewill and Lynning.

From the comparative table given below it will be seen what an enormous advance the *Lion* represents over the earlier battleship-cruisers. At present she is the longest, heaviest and most powerfully armed warship afloat:—

	Lion	*Indefatigable*	*Indomitable*
Length (over all) ....ft.	700	580	562
Beam .....ft.	88½	80	78½
Draught .....ft.	27½	27¾	27
I.H.P.....	70,000	45,000	41,000
Speed.....knots	28-30	27-28	25-27
Displacement.....tons	26,000	20,000	17,250
Coal .....tons	3,500	2,500	3,000
Armament	8 13·5"	8 12"	8 12"
Main belt	9¾" Simpson	8" Krupp	7" Krupp

The armour of the *Lion* will extend from the upper deck to seven feet below the water-line, and, being manufactured by the new Simpson process, will have over 30 per cent. more resisting power than the earlier Krupp.

The main feature of the ship is the armament of eight 13·5" guns, the first time these huge weapons have been mounted on an English ship since 1892. These weigh 80 tons and throw a 1,250-lb. projectile with an initial velocity of 2,016 foot secs., which is sufficient to pierce 22 inches of steel at 5,000 yards. They are mounted in four centre-line barbettes, so disposed that four can be trained ahead, two astern and all eight on either beam.

Fitted with turbines of 70,000 I.H.P., the speed is expected to reach over 30 knots!

We give an illustration of the *Lion* as she will appear at sea, which has been drawn from authentic data. For this reason many details from current "intelligent anticipation" plans may be noted, notably in the number of masts and funnels. The secondary battery will consist of 4-inch guns to the number of twenty or thereabouts. Their exact position on the ship has not yet been definitely decided, but it is understood that they will be distributed as shown in our illustration.

A sister-ship, the *Princess Royal*, is at present under construction at Messrs. Vickers, Sons & Maxim's yard, Barrow.

THORN'S SCHOOL OF MARINE ENGINEERING.—At the examination held for extra first-class engineers in July, the following candidate was successful, Mr. H. W. Hemy, at West Hartlepool. He was prepared by Messrs. Thorn's highly successful system of postal tuition, and passed the first time up, making one hundred and ninety successes in this grade from the establishment of Messrs. W. H. Thorn and Son, 5, Waterville Terrace, North Shields. A record unattained by any other school.

H.M.S. "LION" AS SHE WILL APPEAR WHEN COMPLETED.

WHITE STAR LINERS "OLYMPIC" AND "TITANIC."

THE work on the *Olympic* is now so well advanced that not only is it possible to appreciate the graceful lines of the hull, but to observe in the development of the internal work of the vessel that interesting transition from the plans to the actual structure that is at once the delight and the reward of the constructor. All the hydraulic riveting is now completed, and various portions of the superstructure are in evidence. While the steel workers have yet much to do, they have made such progress that the wood workers and others are able to get ahead with their work in every direction, and the erection of the state-rooms on the various decks is proceeding rapidly, also the fitters' and plumbers' work throughout the ship.

The work at the *Titanic* is also proceeding very rapidly, and relative progress has been made with the construction of the machinery for both vessels.

A vessel with a rudder weighing 100 tons, beams 92 feet long, and steel plates 36 feet long, may be naturally expected to afford some interesting details with regard to the machinery, and it may be mentioned that each engine crank shaft weighs 118 tons; bedplate 195 tons; each column 21 tons, and the heaviest cylinder with liner, 50 tons; wing propeller 38 tons—finished weights. The castings for the turbine cylinder weighed 163 tons, and for the propeller, which is of solid bronze, 22 tons.

It is expected to launch the *Titanic* in October next, and the *Olympic* in May, 1911.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(*From our Own Correspondent.*)

Devonport Dockyard.

THE cruiser *Lion* was launched on August 6th, by Lady Clifden. Nothwithstanding the wet day a large number of spectators were present, including a party of cadets from the American training cruiser *Newport*, which had come into the Sound that morning. The *Lion* will be the largest, fastest and most powerful cruiser in the world, being 720 feet overall, with a beam of 88½ feet and a displacement of 26,000 tons, while her engines are to develop 70,000 horse power and give a speed of 30 knots. Her main armament will consist of eight 13·5-inch guns arranged in four central turrets and her armour protection will extend from the upper deck to about seven feet below the water line. The barbettes are so arranged that the second and third are raised above the foremost and after ones, for all the guns to be fired both ahead and astern. Her measurements exceed those of the *Indefatigable* as follows:—Length, 124 feet; beam, 8½ feet; displacement, 6,000 tons; horse power, 25,000, and speed, 3 knots. The *Indefatigable* is making good progress and will be ready for her steam trials by the beginning of November. The inquest on the victims of the recent explosion in the cruiser *Sutlej* was concluded at the Royal Naval Hospital on August 10th, when the jury found that the explosion was due to a worn tube caused by corrosion. The cruiser *Niobe* is expected to leave for Halifax, Nova Scotia, to take up her duties in the Canadian Navy about the middle of September. The sloop *Espiegle* is to be recommissioned on September 6th for service on the East Indies Station, to take the place of the *Lapwing*, which has been paid off at Bombay and placed on the sale list. One of our vessels, too, has been placed on the sale list—the destroyer *Swordfish*, a 27-knot vessel, which was built fifteen years ago. The Lords of the Admiralty made their annual inspection at the end of July, during which Rear-Admiral Sir John Jellicoe, the Controller of the Navy, and Mr. Marshall, the Director of Dockyards, heard about forty deputations of workmen, who were accompanied by Alderman Jenkins, of Chatham. Admiral Sir Wilmot Fawkes visited the Royal Naval Engineering College on July 27th and presented the prizes to the last batch of cadets who entered under the old *régime*. The Commander-in-Chief said that there was general regret at the closing of a college which had achieved remarkable success during its thirty years' existence, the engineer-officers trained there now controlling machinery of six millions horse power. The college was closed four days later. The half-yearly prize distribution to the boy artificers who were recently transferred from Chatham was held on August 5th on board the *Indus V.*, the awards being presented by Engineer Rear-Admiral G. Elbrow. The Admiral in addressing the boys said that the training of boy artificers was, to his mind, a very important matter and worthy of all the attention that could be bestowed upon it. It has been officially announced that Rear-Admiral R. H. S. Stokes is to succeed Vice-Admiral Cross as admiral-superintendent, and he is expected to take up his duties in September.

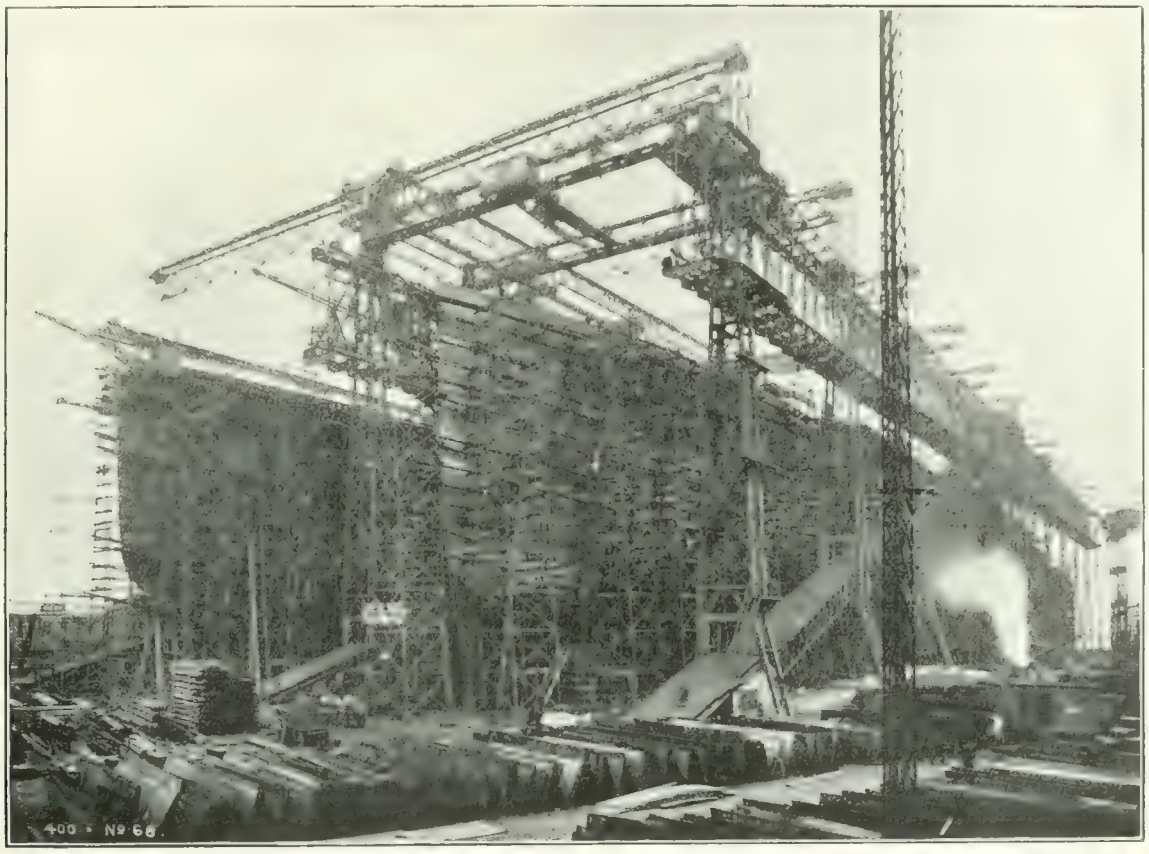
Chatham Dockyard.

The Japanese cruiser *Ikoma* arrived here on July 27th and was taken into the steam basin, the officers next day being entertained to dinner by Commodore Thursby and the officers of the Royal Naval Barracks. Entertainments for both officers and men were provided by the naval and civil authorities, and our Japanese guests enjoyed themselves remarkably well. The cruiser remained a week and then went on to Portsmouth. Admiral Sir Charles Drury, the Commander-in-Chief at the Nore, and Lady Drury gave a farewell reception at Admiralty House on August 2nd to Captain Shoji and his officers, who were previously entertained to dinner by Rear-Admiral Ommanney, the superintendent of the yard, and Mrs. Ommanney. The mine-layer *Andromache*, which with other vessels had been carrying out exercises in the North Sea in connection with the mobilization on the East Coast, returned on August 2nd. Her boats and davits on the starboard side had been crushed, the steamship *Neapolitan Prince*, which was being used as a transport, having collided with her the previous night when leaving Harwich with troops for the "Invasion" of Kent. The *Andromache* was at anchor at the time of the accident. The cruiser *Naiad*, which has been fitted at a cost of upwards of £30,000, for service as a mine-layer, was commissioned on August 23rd by Captain Heneage, late of the *Andromache*, for service at Portsmouth. When the repairs of the *Naiad* were stopped at this yard five years ago, and she was put among the non-effective vessels, it appeared as if her days were numbered, but in common with many other old vessels a use has been found for her, and she will no doubt do much useful work before she gets to the ship breakers. The *Naiad* is the sixth cruiser of the *Apollo* class to be commissioned as a mine-layer. She has been fitted with wireless and armed with six 6-pounder quick-firers, being the first mine-layer to be armed. The *Intrepid*, which is being similarly converted, will be ready by the end of the year. The destroyer *Scorpion* has been delivered from the works of the Fairfield Shipbuilding Company, and will be commissioned for service in the First Flotilla. The destroyer *Ferret* has been ordered by the Admiralty to be broken up. The vessel, which was delivered from the builders in 1893, distinguished herself a year ago by cutting through the boom defence at Portsmouth, for which purpose she had her bows specially strengthened. Submarine *C33* has been completed and will shortly be commissioned for service in Section 4 Flotilla, at Portsmouth. Good progress is being made with the two other vessels *C34* and *C35*.

Sheerness Dockyard.

Two vessels have recently come into dockyard hands for repair. On August 2nd the destroyer *Ranger*, of the Nore Flotilla, arrived for the repair of damage received through a collision with the pier head at Yarmouth while attending on Section 3 of the submarine flotilla on a cruise along the East Coast. Two blades of the port propellor were broken, the cone of the propelling shaft was damaged, and the shaft was out of line. The following day Torpedo Boat No. 11,

arrived with her stem damaged, as the result of a collision with the sea wall at the eastern entrance to Dover Harbour while taking part in a night attack. The torpedo-gunboat *Hebe*, which was recently damaged in collision in the North Sea, is being repaired and is not expected to be out of hand for another two or three weeks. Submarines *C*1, *C*3 and *C*4, which have been refitted, left at the end of July to resume duty at Harwich in Section 3 of the submarine flotilla, and on August 4th *C*7, *C*8 and *C*9 came in for refit. The tug *Robust* left at the end of July with two lighters and a party of riggers for Scottish waters. Proceeding first to Dundee, the riggers have to relay the moorings of the submarines serving in Section 7, after which they go to Cromarty and put down moorings for the battle practice targets of the Home Fleet and also for an oil fuel vessel at Invergordon. Commander Munro is superintending the work. Engineer Rear-Admiral E. Little has taken up duty on the staff of Admiral Sir Charles Drury, the Commander-in-Chief at the Nore, vice engineer Rear-Admiral R. B. Priston, who had occupied the post for the past two years. The latter officer has since retired from active service. This is Admiral Little's first employment since his promotion in August of last year, at which time he was serving in the battleship *King Edward VII.* on the staff of Vice-Admiral Sir Archibald Berkeley Milne, commanding the second division of the Home Fleet. The results of the examination for the entry of apprentices are not at all encouraging to us. At one time the boys of this port were in the front rank, and several prominent officials received their education in the Sheerness elementary schools before becoming apprentices. This year, however, the first Sheerness boy obtained only 1,029 marks, and he would have been 161st on the list in all the yards.



The building of the White Star Liners *Olympic* and *Titanic*, at Belfast.

Portsmouth Dockyard.

The battleship *Orion* was launched by Lady Winchester on August 20th, her launching weight being about 8000 tons, the same as the *Neptune*. She was commenced on November 29th last, and when completed will have a displacement of 22,500 tons. As to the *Neptune*, it is expected that her steam, gunnery and other trials will take place towards the end of September. The vessel is fitted as a flagship, and it is understood that she is to take the place of the *Dreadnought* as the flagship of Admiral Sir William May, the Commander-in-Chief of the Home Fleet. Satisfactory progress continues to be made with the new lock and dock. The excavations are well forward and the masonry to form the foundations has been commenced. The second-class cruiser *Rainbow*, which has been purchased by the Canadian Government, has left for Esquimalt, to begin her duties in the Dominion Navy under the command of Commander J. Stewart. The vessel was on the non-effective list for five years and was moored at the Motherbank. Her refit was very extensive, especially in connection with her machinery and boilers. She has been equipped with wireless and fitted with two 6-inch quick firers as well as smaller guns. An explosion which caused several injuries to two officers and two men and resulted in three others being burned occurred on August 6th in Submarine *A*1 in Portsmouth Harbour. This vessel has had a remarkable run of ill luck. When she was being completed at Barrow in February, 1903, there was an explosion on board, seven men being injured, while in March of the following year she was struck by the liner *Berwick Castle* and sunk in Spithead, eleven lives being lost. The Japanese cruiser *Ikoma* arrived on August 4th and left on the 10th, receptions, dinners, garden parties and so forth being the rule. Captain Shoji has expressed to the Commander-in-Chief through the Japanese Naval Attaché the pleasure the visit had afforded himself and his shipmates and his thanks for the hospitality they had received. Two days after the *Ikoma* arrived a Russian squadron, consisting of the battleship *Cesarevitch*, flagship of Rear-Admiral Mankowsky, and the cruisers *Slava*, *Bogatyr* and *Rurik*, came in on a five days' visit. The sailors of the two nations that were only a few years ago

at war fraternized and were the best of friends. Needless to say the Russians were entertained in the same lavish manner as the Japanese visitors. Portsmouth boys have again good reason for congratulation, as at the entry examination for dockyard apprentices a Portsmouth boy headed the list with 1,317 marks out of a possible 1,500. It is not often that engineer-officers come in for decorations, and it is all the more pleasurable, therefore, to record the fact that on the King's recent visit to the fleet Engineer-Commander J. T. H. Ward, of the Royal yacht *Victoria and Albert*, was decorated with the Royal Victorian Order.

Pembroke Dockyard.

A brief reference was made last month to the launch of the *Blonde* by Lady Williams. The vessel, whose keel plate was laid on December 6th, is an unarmoured cruiser, a replica of the *Blanche*. Her engines will produce 18,000 horse power and her speed is estimated at 25 knots. Her turbine machinery is being fitted by Messrs. Cammell, Laird & Co., and her armament will consist of ten 4-inch guns, a Maxim and two torpedo tubes. She will have but one mast for wireless telegraphy. The *Blanche* is now carrying out her trials, which are to be completed on August 28th. She will shortly afterwards be commissioned by a crew from Chatham, to which port she is to be attached. The first keel plate of the new unarmoured cruiser was laid in No. 5 slip on July 27th by Mrs. Mundy, wife of the captain-superintendent. The vessel is not to be called the *Barrosa* after all, it having been officially announced that she is to be named the *Active* and her sister cruiser, which will be begun later in the financial year, the *Amphion*. The last *Active*, a cruiser of 3,080 tons disappeared from the "Navy List" about a dozen years ago, while the *Amphion* was only taken off the effective list in 1905. The new ship will be the fifth vessel of the *Boadicea* class to be built. Externally, except at the bow, she will be the same as the *Blonde*, *Blanche* and *Bellona*, but she will be six inches wider and have fifty tons more displacement than the *Boadicea*. The *Active* will differ from her sister vessels in having a ram bow below and an Aberdeen bow above water, the others having the ram below but being practically vertical above water. The vessel does not appear to be making such rapid headway as the previous ships have done, this being due to the fact that but little work had been prepared beforehand, the necessary material not having been available. During the manœuvres ten torpedo-boats were detained here for a week for want of oil fuel. This fact should awaken the Admiralty to the necessity of maintaining a reserve of all kinds of fuel at this yard. In war time such an occurrence might prove to be very serious.

THE NAVAL, MERCANTILE MARINE AND GENERAL ENGINEERING EXHIBITION.

BY the time this journal is in the hands of our readers the Marquis of Graham, C.V.O., will have formally opened the Naval, Mercantile Marine and General Engineering and Machinery Exhibition at Olympia, London. The show promises to be one of exceptional interest to naval architects, shipbuilders, engineers and machinists generally. Many of the latest inventions in connection with all branches of engineering practice will be on view for the first time. Machine toolmakers are particularly well represented. The exhibitors include leading firms of manufacturers and engineers in London, Glasgow, Birmingham, Manchester, Leeds, Bradford, Huddersfield, Hull, Edinburgh, Sheffield and other industrial centres. The exhibits comprise metallurgical processes and raw materials, castings, machine tools and appliances, lifts, lifting appliances, shop tools, contractors' plant, grinding and crushing machinery, tubes and fittings, transport plant, engineers' stores, fire appliances, packings, mechanical stokers and conveyors, warming, lighting, sanitary and ventilating apparatus, dockyard plant and gas, steam and oil engines, etc.

Special meetings of several engineering and scientific societies will be held at Olympia during the period of the Exhibition. The programme of events as at present arranged is as follows:—

Tuesday, Sept. 6th.....Junior Institution of Engineers.
Wednesday, „ *14th*.....Institute of Metals.
Thursday, „ *15th*.....Institute of Sanitary Engineers.
Saturday, „ *17th*.....Institute of Marine Engineers.
Wednesday, „ *21st*.....Society of Engineers.
Saturday, „ *24th*.....Assoc. of Engineers in Charge.

Provision has been made for the admission of workshop parties, etc., engineering and technical students, at reduced rates, who will be able to take advantage of the excursion trains that are run to London during the month of September by all the leading railway companies. The Exhibition will run from September 1st to September 26th, both days inclusive. In our October number we shall describe the exhibits.

RECIPROCATING AND TURBINE MACHINERY.

THE combination set of reciprocating and turbine machinery for marine propulsion has not been adopted yet to any extent, but the fact that enquiries have been made to discover the advantages to be gained by the combination, added to the knowledge of a repeat order being given by one steamship company, go to show that there is reason to expect an extension and development in the combination. The members of the firm which gave special attention to the turbine and its possibilities in the initial stages of its introduction to marine work proved the courage of their convictions by the part they took. The justification of those convictions has since been manifested in many directions. In the combination set it becomes necessary to make provision for cutting out the turbine when going out of or coming into port, so that the reciprocating engines may have perfect freedom of action to carry out the sharp and frequent movements necessitated in compliance with the orders of the telegraph from the bridge. It is only a degree less important to make provision for reducing the action of the turbine gradually and imperceptibly by means of a handy gear which admits of ready adjustment. In order to afford facility for examination and overhaul in the event of one or other of the condensers giving out at sea, a reliable and safe connection is necessary to shut off either side. To deal with these problems the firm already referred to has set itself, and two patents have been taken out for gear and appliances to cover the requirements by Mr. James Denny and Mr. J. Irving, the chief draughtsman in the engine works, Dumbarton. The one patent deals with the manipulating of the steam supply to the turbine without affecting the reciprocating engine; the other deals with shutting off the condenser safely while underway when the necessity arises.

The illustrations which are attached to the specifications setting forth the claims of the patentees we herewith reproduce, as they show clearly the arrangement of the shut-off valve in connection with the condensers for dealing with the exhaust vapour and steam (Fig. 1), and the method is also shown by which the valve and gear regulate or entirely shut off the steam supply to the turbine readily and promptly when found to be necessary (Fig. 2).

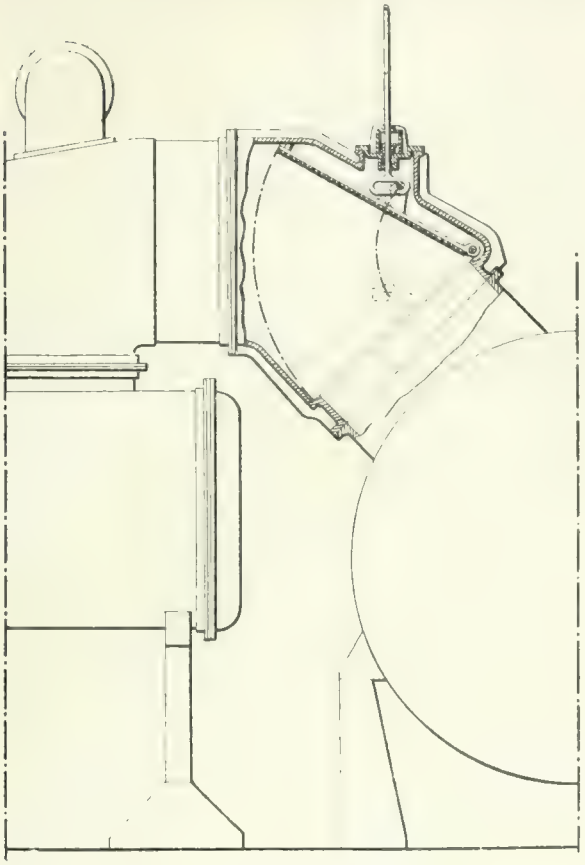


Fig. 1.

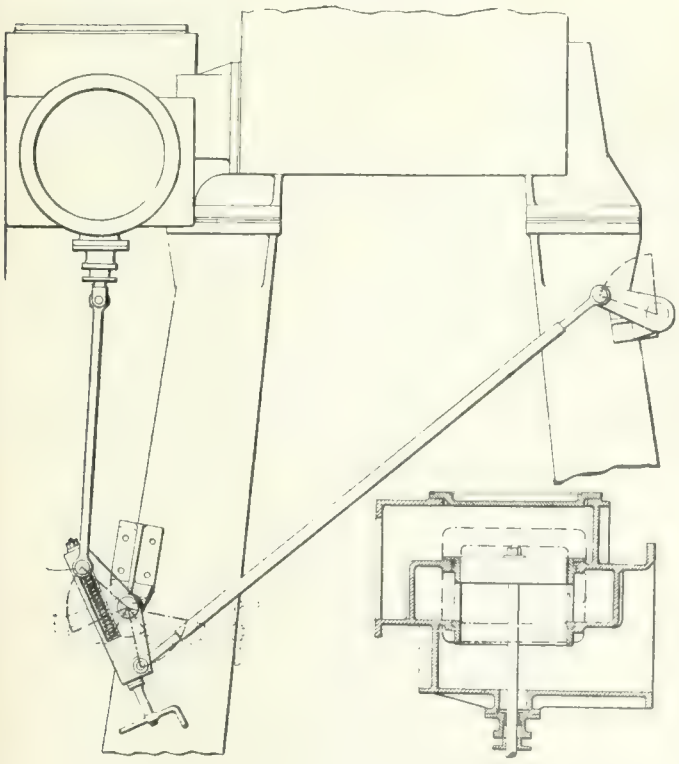


Fig. 2.

(See Reciprocating and Turbine Machinery.)

COMPARISON IN SHIP DESIGN.

IT has often been remarked that there is a very wide difference in the nature of the problems which confront the civil and mechanical engineer and those which confront the naval architect. The civil engineer, for example, has to design a structure which may be, and often is, complex, but which is, to a much greater extent than can be claimed for a ship, determinable. He may be beset by difficulties relating to wind pressure, to the nature of his foundations, and to change of temperature. But in all these he also has the benefit of reliable experimental data, and he can make a reasonable estimate of the magnitude of the actual forces with which he has to deal. In a sea-going vessel, however, no such estimate can be made. No one can say, even approximately, what actual deforming forces the structure must resist. The whole mass is constantly in motion, and is, besides, susceptible of an infinite variety of methods of loading which cannot be predicted with certainty. A ship also possesses far more elements of redundancy than the majority of land structures with which we are acquainted. Imagine for one moment the difficulty of designing from first principles a web-frame ship, with its ordinary frames, its web frames and side stringers, its cellular double bottom consisting of mutually-dependent floors and girders. The design of such a vessel is an enormously complex business, and we have little doubt that these inherent difficulties will go far to explain why it is that empirical methods have so long prevailed in ship design, and why ship-building generally has been for so long the peculiar preserve of the "practical man."

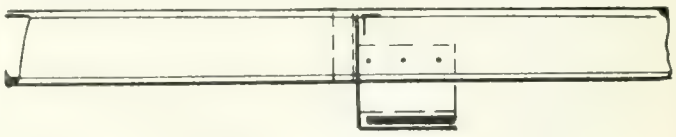
If the difficulties indicated above be understood, it will be easy to understand also that the essence of ship design is in the nature of a system of scientific *comparison*. It has been found out from experience that a certain vessel, or type of vessel, has given satisfaction under certain conditions. We take, therefore, that vessel or that type, and we use our knowledge of the principles which govern the correct combination and disposition of materials to enable us to obtain a *relative* solution of the problem we are dealing with. Further, we may use that knowledge to examine and compare different parts of the structure, and, assuming the same conditions in each case, to determine whether or not it might be possible to reduce the material at any given part. The whole investigation, however, is a comparative one, and it becomes of great importance in making it not only to know one's subject thoroughly, but also to take into due account *all* the factors which differentiate one case from another.

Now it is very seldom that one finds that this is done. Take, for example that very large and important amount of investigation involved in the examination of the strength of ships. Again and again it is found that the most incorrect comparisons are made, and it would sometimes appear that a mere statement of the different moduli of resistance of various sections, or a simple application of some bending moment formula, provides a magically easy solution of the most difficult problems. It is quite forgotten, if it is known, that the ordinary approximate theory of beams depends on some half-dozen assumptions, and is only valid if these preliminary conditions are fulfilled. In making a comparison of the strengths of

frames or beams, due regard should be had to the nature of the end constraints in each case, to any defect in the continuity of the section, to any want of symmetry in one section not existing in the other. It would be wrong, for example, to compare a bulb tee beam supporting a wood deck with a bulb angle beam also supporting a wood deck, and to take no account of symmetry of section. Suppose, again, that we are comparing a system of beams supported in one case directly by pillars, and in another case supported by widely-spaced pillars and girders. The pillars in the latter case would be spaced certainly about 20 ft. apart, and perhaps would be much wider. The intermediate beams would be supported by the strong fore and aft girder at the heads of the pillars. As the span between the pillars in the latter case is increased, more material is put into the girder, enough probably to keep the normal stresses to which it is subject constant, but certainly not enough to keep its stiffness constant. Due to the load received from the intermediate beams, the girder will deflect sensibly, and the intermediate beams themselves will then be in the position of continuous girders with the intermediate supports subsided. In the former case, with each beam supported directly by a pillar, the amount of vertical deflection under the support may relatively be disregarded, and it is easy to see in the latter case how fundamentally the bending moments along the beam may be altered in disposition, and how the stresses may be increased in magnitude. We have never seen, however, any account taken of this, nor any proposal to increase the material in the girder on the ground of providing increased *rigidity*. In fact, rigidity as such receives far too little attention at present, especially in oil work, where, for obvious reasons, it is especially important. It would be easy to design a deep frame for an oil vessel to give equal strength to the usual web-frame arrangement with considerably less rigidity. Instances connected with the subject of beams might be multiplied from ordinary practice; they will easily occur to the reader and need not be elaborated here.

The design of pillars, again, provides many instances of incorrect comparison. It is not an uncommon thing to find a pillar of unsymmetrical form substituted for one of symmetrical form—a single channel for a double channel, for example. The same amount of material may be in both, yet the least moment of inertia of the substituted pillar may only be a fractional part of that which it replaced. For similar pillars, also, the principle of similarity is often used irrespective of the type of end fixing, and pillars having no bracket connections at their ends are compared on the same basis with those which have. Another common error is to suppose that a round hollow pillar is necessarily made stronger by an increase in the diameter accompanied by a decrease of the thickness. It might be so if primary flexure alone be taken into account, but it has been recently and very clearly shown that our ordinary pillar formulæ are defective in the respect that they do not take account of secondary flexure. Such a pillar might quite easily fail in this latter manner, and in applying the ordinary pillar formulæ in a comparative sense, it is necessary to bear this consideration constantly in mind, in those cases to which it is applicable.

In comparative investigation of strength there is one other piece of forgetfulness of which mention might be made. It is too often forgotten that those shear and tensile stresses of which we speak so easily, are after all, only component stresses resolved, for the sake of convenience, in certain definite directions. It by no means follows that they represent the *maximum* stresses to which the material is subject. It may quite well be, and often is, the case that a tensile stress of a lesser amount when combined with the correct tangential stress, gives a principal stress much in excess of that existing in a material bearing a higher tensile stress. There is an application of this which is interesting because it is an outcome of quite recent practice. It is becoming quite common to depart from the ordinary forms of girders under beams consisting of double channels or double angles, and to fit, say, a flanged plate with the flange reinforced by a



continuous rider plate. The sketch shows the form of construction adopted, the flanged part of the plate being supported from the beams by brackets placed at suitably close intervals.

Now to increase the head room the girder is often made as shallow as possible, and the material is concentrated on its lower edge, and it would be quite easy, so far as tensile stresses are concerned, to make it equivalent to the double channels or double angles more usually fitted. That, however, is only a partial view, and the principal stresses might vary considerably. If a point on the web just below the flanged part be considered, it will be found that the shearing stress there, does not differ by a very great amount from the maximum shear in the web. In addition, the shear stress is high, because at the point where the web crosses the beam the former is much reduced. Also at a point just below the flanged part, the tensile stress will not differ sensibly from the maximum tensile stress incident upon the outside fibres. It follows, then, that you have to compound a tangential stress not much reduced from the maximum, with a normal stress also not much reduced from the maximum, and the result may be a principal stress of an unduly high amount. Thus a tensile stress (under certain assumed conditions) of 9 tons per sq. in. when compounded with a shear stress of 8 tons per sq. in., gives one principal stress of about 13½ tons per sq. in. This arrangement may have been compared with another one in which (under the same assumed conditions) the tensile stress was 10 tons per sq. in. and the shear stress 4 tons per sq. in. These compounded give a value for one principal stress of 11½ tons per sq. in. Looked at in the usual way the former arrangement of flanged plate is stronger than the latter, whereas the reverse is true. An example like the above shows very clearly how fallacious it is to make one particular component of stress the determining factor. The same consideration enters into the few cases in which a ship designer requires to consider torsion, and indeed the general necessity for correct comparison extends over the whole field of ship design. More particularly is this the case in questions of propulsion, but this may be conveniently referred to later.

THE LANZ TORPEDO-BOAT ENGINE.

IN the review of the Brussels Exhibition, published in the July number of this journal, mention was made of a very interesting torpedo-boat engine made by Mr. Henrich Lanz, of Mannheim, by whose courtesy we are enabled to publish the description given below.

The most important departure from usual practice is in the method of steam distribution, and before describing the details it will be of interest to discuss the reasons for the change. Up to within a few years the marine engine was more, or at least quite as economical as the best type of stationary engine, but now the latter is far in advance of the standard slide-valve marine engine. Probably the chief reason for this superiority is the general use of superheated steam, but, in addition, there have been great improvements made in the valve gear. With the ordinary slide valve there is a continual wire-drawing throughout admission of the steam, also the alternate contact of hot and cold steam on the valve surfaces causes much initial condensation. Corliss and Poppet valves, by their quick opening and closing and from the fact that separate valves are provided for steam and exhaust, have largely eliminated these losses.

Although superheated steam is used with more or less success with all kinds of valves, general experience, at least for high temperatures, points to the double-seated Poppet valve as being the most suitable. In this country very little has been done to apply superheated steam to marine engines, but on the Continent, where there is an ever-increasing recognition of its possibilities, it has been found that wherever used economy has resulted. The only detriment has been increased wear and tear on slide valves. The superheating apparatus is far beyond the experimental stage and presents no difficulty. The Lanz system combines all the advantages of the Poppet valve, allows the use of superheated steam without excessive wear and tear, and is a notable simplification of the standard slide-valve arrangement. Referring to Figs. 1 and 2, which show a section through a cylinder and valve passages, it will be seen that there are two Poppet valves at either end of the cylinder, one for exhaust and the other for steam. The valves are kept on their seats by long spiral springs. Midway down the cylinder is a shaft carrying two cams, one for each valve line. The cam is shaped so that the valves are opened quickly (without causing wire-drawing), kept wide open for practically the whole period of admission or exhaust, and then closed at once, but without noise or shock. The valves have very narrow seats, and as the springs are long, the load on the actuating mechanism is small, especially when compared with that caused by flat slide valves. The application of the valve gear to the engine shown at the Exhibition can be seen from the front view in Fig. 3. It is of the four-cylinder compound four-crank type, having one H.P. and three L.P. cylinders all of the same diameter, enabling the same parts to be interchangeable for each piston line, and thus the number of spares required are a minimum. The leading diminsions are:—

H.P. and L.P. cylinders, diam., 1,000 m/m.
Stroke, 500 m/m.
Steam pressure, 16 atmospheres or 240 lbs.
Normal horse power, 6,500.

So far as the framework, connecting rods and guides

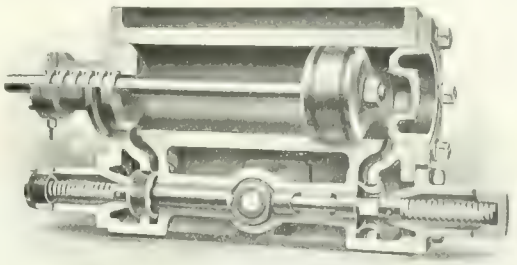


Fig. 1.

are concerned the usual torpedo-boat construction is followed, but as all the valves are at the back of the

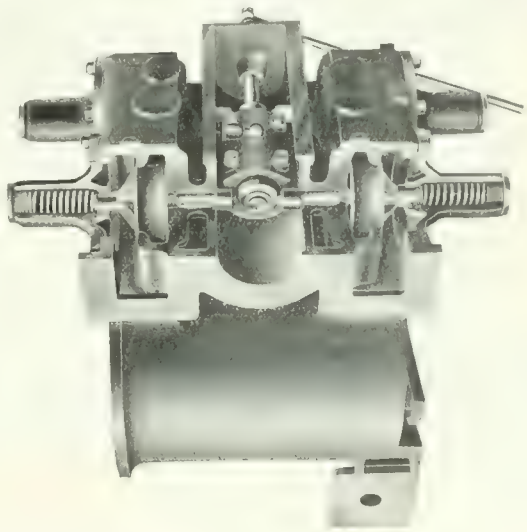


Fig. 2.

engine the cylinders are brought close together, shortening the receiver pipes and eliminating the four

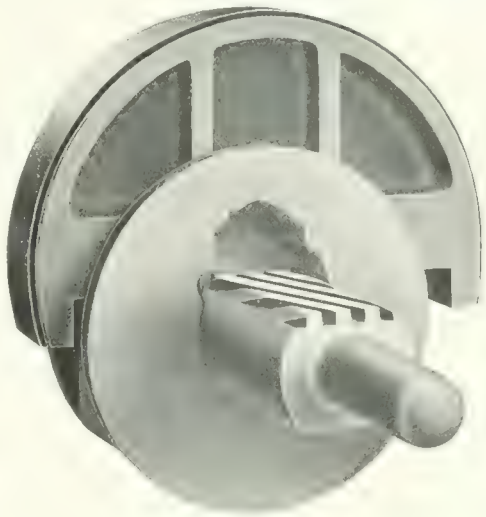


Fig. 3.

complicated, troublesome sets of eccentrics and reversing links, etc. The simple, plain appearance of

the engine is at once apparent. Each cylinder is fitted with four valves like those shown in Fig. 2. The control and reversing gear is at the H.P. cylinder end of the crank shaft, which is lengthened to take three eccentrics. By axial displacements of a spindle inside the shaft with slanting teeth these engage in corresponding teeth of the eccentrics, and by means of the vertical hand-wheel seen in Fig. 3, the reverse can be effected. The arrangement of teeth in the eccentrics can be seen in Fig. 4. The slanting teeth are adjustable in order that the cut-off may be varied in the H.P. and L.P. cylinders. Adjoining cranks are displaced 180 deg. to each other, and the forward pair are at 90 deg. to the after pair, thus a regular supply of steam is assured to each cylinder and the turning movement is good.

The eccentrics mentioned serve for the movement of the hollow eccentric shaft (Fig. 3), which carries two double cams for operating the valves of the H.P. cylinder. The second eccentric serves for the hollow shaft carrying the cams of the L.P. cylinder next to the H.P., while the third eccentric works the inside shaft, which extends the whole length of the engine and carries the cams for the other two L.P. cylinders.

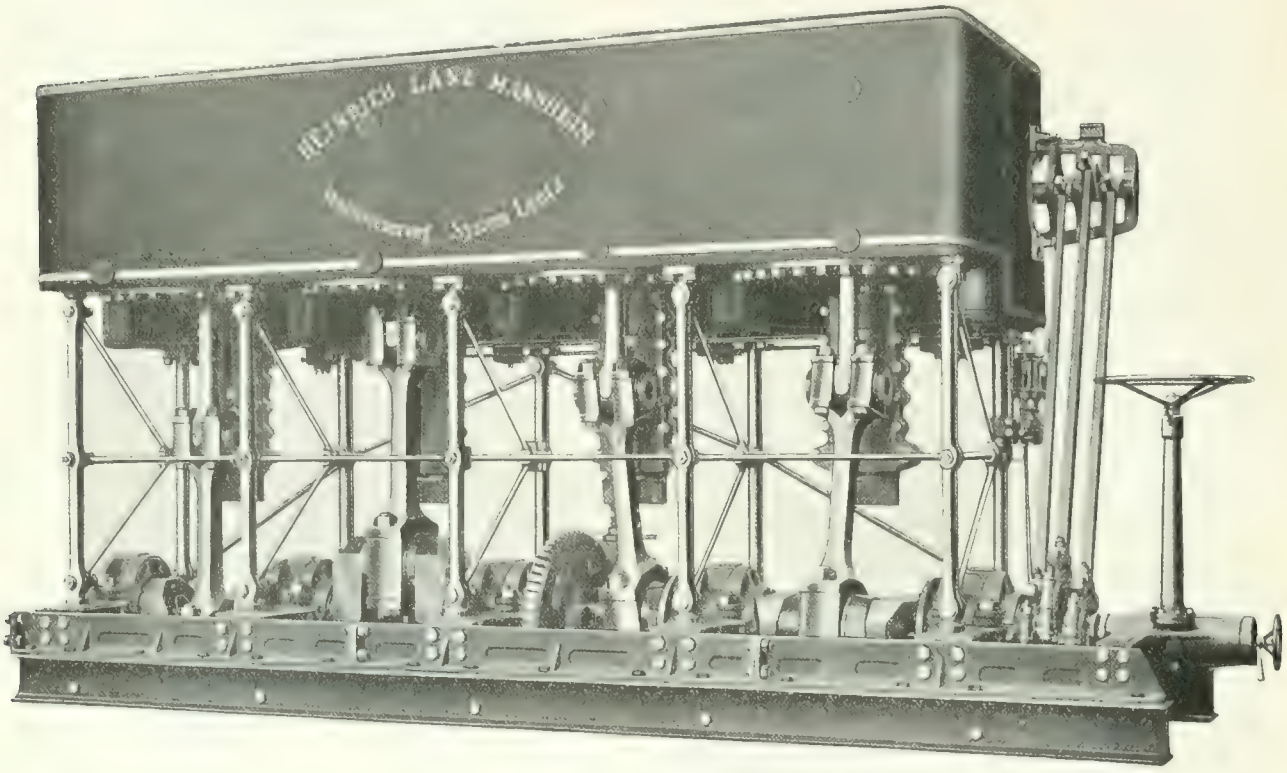


Fig. 3

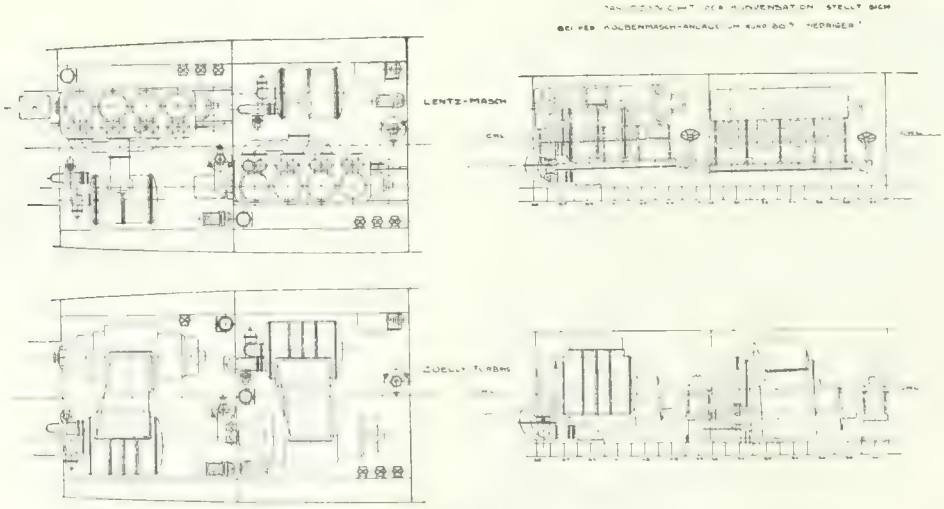


Fig. 5

Each of the control shafts runs in ball bearings, and they are arranged so that the short shafts telescope over the long ones, but they do not touch each other.

From the above description it will be recognised that this engine is especially adapted to torpedo boats, and to illustrate its compactness and small weight the makers have drawn the comparative diagrams (Fig. 5), which show the space occupied by the Lanz engine and a Zoelly turbine; the engine is taken at 250 revolutions per minute and the turbine at 650. The relative space occupied can be readily seen. The weight of the engine is 50 tons and of the turbines 52 tons, but as the latter requires a very high vacuum the weight of its condensing apparatus is one and a half times that required for the engine.

In conclusion, it may be pointed out that the valve gear is by no means new—the makers have used it on other engines for years—and as the engine compares so favourably with the turbine, marine engineers will watch with interest any warship to which it may be fitted.

CROSBY'S WATER ARRESTER AND CHIME SIGNALLER FOR STEAM WHISTLES.

CONSIDERABLE attention is now being given to the proper provision of means for ensuring the certainty of action of steam whistles as signalling devices, and as is well known one of the causes of failure is the presence of water in the whistle pipe. The Crosby Steam Gage & Valve Company, of London, are putting on the market a new design of water arrester, adapted to separate the water from the steam at the whistle, and ensure the supply of steam only thereto. In the adjoining illustrations, Fig. 1 is

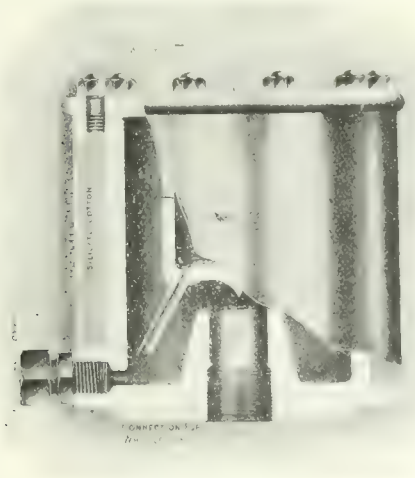


Fig. 1.

a part sectional view of this arrester, which consists of a jacketed chamber to which the steam pipe from boilers is connected at the bottom where an upwardly extending nozzle is arranged. Within the chamber is another chamber depending from the cover, having a series of perforations in its side walls, and a drain pipe leading to the lower part of the main chamber from which the water is led away by a drain pipe. Any water driven up the whistle pipe is projected against the bottom of the internal chamber which, being of a special form, deflects the water downwards. Fig. 2 shows the device in position with the whistle attached, and also an electrically controlled apparatus of a chime attachment which we shall now describe.

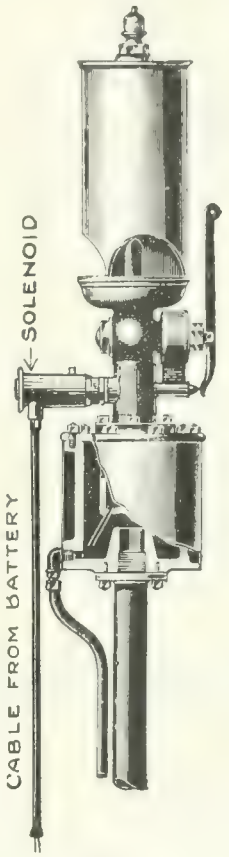


Fig. 2.

This arrangement is an automatic timing device consisting of a cast-iron box containing a substantial clockwork movement, operating a set of electrical contacts. A mechanical switch is provided for setting the

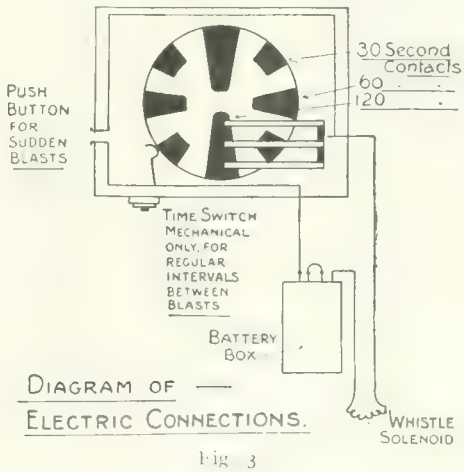


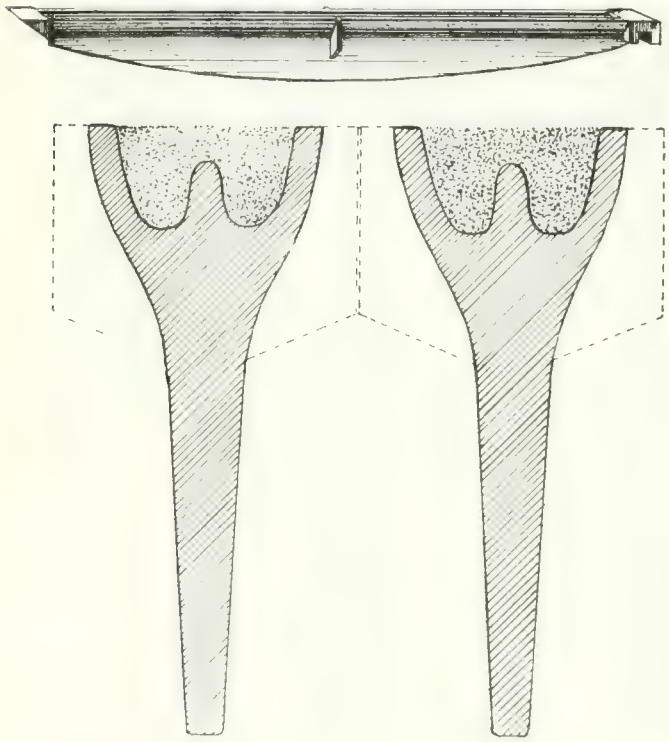
Fig. 3.

time intervals and an electric switch or push button for obtaining sudden blasts. These can be obtained at any time without interfering with the clockwork which can remain set for intermittent blasts. Fig. 3 shows

diagrammatically the switch battery and electrical connections. It will be seen that there are three distinct contact variations; assume that the switch is rotated by the clockwork, one revolution in four minutes, then according as to whether contact is made twice, four times or eight times per revolution, one gets 120 seconds, 60 seconds or 30 seconds intervals between the blasts. The current for operating the whistle is extremely small and can readily be obtained from batteries, if it is desired to be independent of a lighting or power circuit. The current acts on a solenoid contained in the small case to the left of the whistle valve (Fig. 2), which in turn operates a valve on one side of a balanced piston which is open to the atmosphere. This destroys the balance of pressure; the auxiliary valve is opened by the steam which in turn opens the main valve, the action being practically instantaneous. It will be noticed that a push button circuit is provided for sudden blasts.

THE "TRIDENT" FIRE-BAR.

ONE more patent fire-bar has been placed on the market to compete with those already in use and going out of use. There are others under discussion akin to the moving bars found in general use on land boilers, and, should success crown the efforts of the experimenters, we may see the mechanical



stoker also evolved for marine work. There is an opening for such an evolution in the stokehold, involving a possible revolution from present modes and methods of firing. The Trident fire-bar, having been fitted to several steamers on trial, is claimed to have a longer life than the ordinary bar, while it is lighter in the aggregate per furnace, due to its shape. By its use the formation of clinkers adhering to the bar is prevented, with consequent ease in cleaning fires. The bars, it will be seen from the illustration, have grooves which are filled with fine ash to prevent the clinker gripping the cast iron. These bars have now seen service for over a year and a half with results which presage a considerable extension in their adoption for marine as there has been for land boilers. As a proof of the success of the Trident fire-bars it is worthy of special attention that since the end of 1908 no less than 400 steamers have been supplied with them, many of these being owned by large companies sufficiently conservative to justify the comment that their adoption in these cases is itself a guarantee of improvement over other types of bars, especially when the bar is included in the specification of new steamers. The intention and design of the Trident bar are in the direction of economy, not so much of coal as of fire-bars, but incidentally the advantages gained on the one hand in outfit and upkeep by the adoption of this type of bar also reflect very favourably in the direction of the fuel consumption; on the other hand, in conserving heat and preserving the bars and preventing the clinkers adhering to them; the furnace doors will thus be opened for shorter periods to clean fires, and to renew bars seldom or never. The clinkering on and adhesion to fire-bars was a grievous trouble with forced draught, especially when first introduced. The difficulty was overcome to some extent by grooving the ordinary bar and filling it with ash or sand, but it was found in practice that the groove soon became non-effective; the surface of the groove was too shallow. The Trident bar, on account of its formation, has a deeper groove and wider, due to its shape. It is therefore not so liable to have the clinker sticking to the bar, with the consequent lessening of work by the firing tools to remove it. The formation of the bar renders the air courses from the ashpit to the grate surface much easier, while the cooler bar tends to a more gradual heating of the air in its passage. The volume is thus kept greater right up to the time of uniting with the fire. The bars can be fitted to any existing furnace; no changes are necessary. One set of ordinary bars weighs more than a set of the Trident bars; the quantity is much reduced, approximating, say, two to three of the former to one of the latter. The gross weight of a set of Trident bars is thus less than a set of common fire-bars. The extra cost of the former, by reason of the shape and formation, with its several advantages places the Trident in a good position for competing in the market, even on its comparative price, with the ordinary bar. The Trident firebar is placed on the market by the Liverpool Patents Co., Ltd., 9, Rumford Street, Liverpool. The firm has also an agency in London, and a model of the bar is on view in the Machinery Section of the Exhibition at Shepherd's Bush.

LIFE-SAVING APPLIANCES ON CARGO STEAMERS.

RECENTLY, in fining the master of a coasting steamer £5 and costs for permitting the life-saving appliances on his vessel "to become defective and unfit for use in various respects," the presiding magistrate in Falkirk Sheriff Court said that it should be better understood and remembered that the Legislature in making the regulations under the Merchant Shipping Acts as to life-

saving appliances had in view the lives of seamen as well as of passengers. An agent on behalf of the master stated that the annual overhaul of the vessel was shortly to have taken place, but "unfortunately" while the vessel was lying at Redcar, near Middlesbrough, an officer of the Board of Trade visited the vessel, and as a result the complaint had been made. In the interests of seamen of all classes, of officers and engineers, and even of the captains themselves (who may often enough be the timid slaves and victims of cheese-paring owners and managers) more "unfortunate" visits of the kind should be paid to cargo-carrying vessels—and to passenger-carrying vessels as well. About this time last year the master of a Sunderland steamer was at Newcastle fined £25 and costs for having whilst on a voyage from the Tyne to Rouen and back to Blyth, neglected to keep the life-saving appliances in such a condition that they might be at all times fit and ready for use. An agent on behalf of the Board of Trade said that "of the twenty-three life belts on board nineteen were absolutely unserviceable, owing to the tapes and canvas covers being quite rotten. In addition the eight lifebuoys on board were in such a condition that when tested four of them sank." That in the case of lifebuoys, as ordinarily made and carried, deterioration is rapid and insidious and may not always be observable or even suspected, is quite understandable. Lifebuoys as usually made—a ring of cork built up of little pieces, more or less firmly joined together, and covered with canvas—and exposed as they are to all conditions of weather, are subject to rapid deterioration. The canvas wears and becomes rotten or gets cut and thus allows rain and sea water to get below the surface until the buoy becomes sodden and water-logged. Unless constantly seen to they prove, in an emergency, more like "death-traps" than life-saving media. Metallic lifebuoys, of copper alloy, having the approval of the Board of Trade and other bodies, and now largely fitted on high-class passenger, river, channel and ocean-going steamships — especially those trading in Eastern waters and hot climates — are exempt from such latent and serious defects as are referred to. Although the first cost of the patent metallic lifebuoys made by Joseph Sankey & Sons, Ltd., Bilston, is greater than the ordinary cork and canvas article, they last, with ordinary care, as long as the ship, are one-third lighter than cork buoys, and are at all times equally buoyant and efficient. Their superior lightness and buoyancy never become impaired through accumulated coats of paint, nor destroyed altogether through absorbing water and becoming sodden as in the case of cork and canvas buoys.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(*From our Own Correspondent.*)

Messrs. Alex. Stephen & Sons, Ltd., Linthouse, have received an order from the Anchor Line (Messrs. Henderson, Bros., Ltd.), to build two large cargo and passenger steamers for their trade from Glasgow and Liverpool to Calcutta. The new steamers, which are expected to be ready for work about June of next year, will be of the following dimensions :—410 ft. long, 53 ft. beam, and 32 ft. 6 in. moulded depth, and will have a deadweight capacity of 8500 tons. Triple-expansion engines will be supplied by Messrs. Stephen of sufficient power to give a speed of 12 knots when loaded at sea. Messrs. Henderson have at present the *Cameronia* in course of construction at Messrs. D. & W. Henderson's, Meadowside, which will be larger and faster than the *Caledonia* and *Columbia*, and will, under ordinary weather conditions, land passengers on Saturdays at New York and Glasgow. Including the *Cameronia*, the new tonnage building on the Clyde for the Anchor Line aggregates close on 28,000 tons.

The Clan Line have also ordered from Messrs. Stephen a steamer of large tonnage, and at the present time six of the eight large building berths in their shipyard are occupied with vessels of large size, for important shipping concerns. Three of these are for the British India Steam Navigation Co., designed for their passenger and cargo-carrying service along Indian coast. One of these vessels is to have a speed of 17½ knots on service, and is constructed on lines which combine cargo-carrying capacity with the rate of speed stated. The bulk of the tonnage now produced by Messrs. Stephen is of increasing volume, and for the most part represents high-class passenger and cargo tonnage, affording work for all classes of shipyard artisans.

Messrs. William Simons & Co., Ltd., Renfrew, have been officially informed that they have been entrusted with the contract for the construction of a large bucket ladder hopper dredger for the Panama Canal. Messrs. Simons' tender was 399,340 dollars—over 50 per cent. less than the only American tender submitted. It is of interest to recall that the last occasion on which Messrs. Simons tendered for dredging plant for the Panama Canal their tender was considerably under the lowest American offer, but that owing to a special resolution put into force by Congress at that time the contract was not given to them. The firm have reason, therefore, to be congratulated on their success on this occasion. The great difference in price is no doubt partly accounted for by the wide experience which the Renfrew firm have had in the construction of vessels of this type, of which indeed they are the inventors and first constructors. They built the first dredger of the type for the Canadian Government in 1872.

Messrs. Yarrow & Co., Scotstoun, Glasgow, have at present in hand two destroyers for the British Government of a special type. They are also building in Holland two destroyers, 230 ft. long by 21 ft. 6 in. beam, for the Dutch Government, and they have in hand one destroyer for the Portuguese Government, the hull of which is being built in Lisbon and the machinery and boilers supplied from Messrs. Yarrow's works at Glasgow. They are also building two fast gunboats, propelled by internal combustion engines for the Governor General of Bagdad.

Messrs. Lobnitz & Co., Renfrew, on August 10th, launched a self-propelling bucket dredger, designed to dredge to a depth of 14 meters below water, built to the order of the Leopoldina Railway Co., Brazil. The firm have also just completed two hoppers for the same owners, to be used in connection with the dredger.

Messrs. Russell & Co., Port Glasgow, who have already built ten steamers for the Nelson Line (Messrs. H. & W. Nelson, London and Liverpool) have just received an order for a further vessel of about the same dimensions and power as the four steamers immediately preceding. One of these, the *Highland Glen*, is at present fitting out at Greenock, and another, the *Highland Scott*, has recently passed through her speed trials and been handed over. It is worthy of note that including these four vessels and their predecessors a fleet of merchant steamers has been built in the short period of twelve months, consisting of about 80,000 tons and involving well on to £2,000,000.

Messrs. Wm. Hamilton & Co., Port Glasgow, who launched early in August another vessel for Messrs. John Holt & Co., Liverpool, having her structure on the Isherwood longitudinal principle, and with her interior fitted with provision against the inroads of mosquitoes, also sent off the stocks on August 11th a steel self-docking pontoon floating dock for South American owners. The dock, which is the fourth floating dock built by the firm, has a lifting power of 1300 tons, and is arranged to dock vessels up to 250 ft. in length. The structure is made up of five separate pontoons connected by two continuous sidewalls. The pumping machinery consists of two large horizontal, centrifugal pumps made by Messrs. Drysdale & Co., Yoker, placed direct on the main drain, actuated through vertical shafting by steam engines. During construction the dock has been superintended on behalf of the owners by Mr. Crookston, London, while the material and workmanship has been carried out under Lloyd's survey. Immediately after the launch the dock was towed to the James Watt Dock to undergo testing trials. Afterwards she will be towed to Bahia, Brazil.

Messrs. Scott's Shipbuilding and Engineering Co., Greenock, at the beginning of August, received from the Admiralty the order to build and engine a steamer of 320 ft. in length, which is to be used as a depot ship for submarines. She will be a twin screw, and will be supplied by the builders with all the machinery for the workshops which will be on board. This, it is said, is a new departure for the Admiralty, who have various repair ships but none similar to this. The contract is an important one, and has been welcomed at Greenock, as has also the further contracts received by Messrs. Scott for the construction of a large passenger and cargo twin screw steamer for foreign owners, and for one of 12,000 tons for Messrs. Alfred Holt & Co., Liverpool.

Messrs. George Brown & Co., Garvel Shipyard, Greenock, have been commissioned by Messrs. John Reid & Co., naval architects, Glasgow, on behalf of colonial owners to build a steam tug boat, the machinery for which will be made by a Glasgow firm.

The Campbeltown Shipbuilding Co. have received an order from the Union Steamship Co., of New Zealand, to build a screw steamer of about 2400 tons deadweight.

Messrs. Ramage & Ferguson, engineers and shipbuilders, Leith, have received through Mr. A. H. Brown, naval architect, London, an order for a steam yacht of about 700 tons for foreign owners.

The Thornbush Foundry Co., Inverness, on August 9th, launched from their slipway a steam drifter of 82 ft. length and 18 ft. beam, built to the order of the Inverness Drifter Co., Ltd. This is the second vessel of the kind which this company have constructed.

Messrs. William Beardmore & Co. are pushing ahead with their "Peck" type of oil engine suitable for fishing craft. They have a 70 ft. Buckie boat in hand now for one of these, to drive her at 11 knots on five gallons an hour, and it is understood that they provide an engineer for her for a period, free of charge, till the fishermen are familiar with the working of the motor.

Big Ships and Clyde Deepening.—The trustees of the Clyde Navigation at their last meeting unanimously approved of a recommendation of their committee on Harbour and Graving Docks to proceed at once with a systematic deepening of the river channel, to meet the increased size and draught of steamers trading to the port of Glasgow. The work is to be, as far as practicable, carried out continuously, in order to afford as soon as possible, from Yorkhill to Newark Castle, Port Glasgow, a depth at low water ranging from 23 ft. to 24 ft. 6 in., being an increase of 2 ft., which will enable vessels drawing 31 ft. to leave the harbour two hours before high water. While there can be no doubt there will soon be still larger vessels sailing from Glasgow, which will require a deeper channel than exists, it should be understood that the decision come to is not by any means a new departure, nor is it something the cost of which will swell the expenditure for the year beyond ordinary limits. It is practically a continuation of the work of deepening which is being constantly maintained by the dredging plant of the Trust, but is more strictly a continuation of, or analogous to, the operations which were carried out between Clydebank and Newark Castle previous to the completion of the *Lusitania*. The straightening, widening and deepening of the channel at that time enabled the large Cunard liner to be taken safely to the sea drawing 29½ ft. of water. What was done then below Clydebank is now to be done above Clydebank, and when the work is completed there will be, from Yorkhill to Newark Castle, a depth at low water ranging from 23 ft. to 24½ ft., the present depth, ranging from 21 ft. to 22½ ft. The average rise and fall of the tide is about 9 ft., so that there will be, with the extra 2 ft. of depth, an average depth at high water of 32 ft. to 34 ft. Vessels drawing 31 ft. will be able to leave the harbour two hours before average high water. The largest vessels at present using the port frequently leave on a draught of 28 ft., and for these the present channel is quite sufficient, but the trustees are looking forward to the time when vessels drawing more than 30 ft. will be regular traders with the port. The new quays at Yorkhill and Meadowside have their foundations sunk 28 ft. below low water level, and the depth of water over the submerged Elderslie Rock has been increased to 28 ft. It therefore now remains to make the ordinary navigable channel of a uniform depth all the way. Apart altogether from the question of this uniform depth being required at a comparatively early date, the present is a fitting time for carrying out the work. The Trustees have no large works of harbour or dock extension underway, and they can do all the dredging necessary within the limits of the expenditure of an average year.

TYNESIDE AND WEARSIDE.

(From our Own Correspondent.)

Tyneside.

General.—The general tone among shipbuilding interests is at present somewhat unhappy. Although it is not anticipated that there will be a strike, the result of the ballot among the joint trades employed in the shipyards recommending an advance of five per cent. on piece prices and ¼d. per hour or 1s. per week on time rates as from the first full pay in September presents disquieting features. It is to be hoped that after the inconclusive result of the conference between masters and men at Carlisle the executives of the different societies will endeavour to curb the tendency towards a strike. Another point which is exercising Tyneside shippers is a feeling that a strike among seamen and firemen of cargo and passenger vessels may occur shortly. It is not, however, considered that even if such a strike occurred it could be of any great duration. Another setback which trade has had is the spasmodic strike on the North-Eastern Railway, which seriously interfered both with working cargoes and bunkering both on Tyneside and Wearside. In spite of all these troubles, past and prospective, Tyneside trade appears to be improving.

North-Eastern Railway.—Largely owing to the enterprise of the North-Eastern Railway, a new set of staiths are shortly to be erected at Derwenthaugh, a position somewhat to the west of the existing Dunston staiths. The increased facilities offered by this development are not merely an increase of shipment capacity of two million tons of coal per year, but also that an adequate outlet will be given to the mines of north-west Durham, and it will be possible to ship coal at a higher level at all states of the tide than can at present be done on the Tyne.

The Dry Dock Scheme.—The scheme of making Newcastle a naval base is not yet dead. At the Chamber of Commerce it was resolved to keep the question prominently before the public, and to move a special resolution regarding the matter at the September meeting of the Associations of Chambers of Commerce.

Messrs. W. G. Armstrong, Whitworth & Co., Ltd.—It is interesting to note that the Newcastle Corporation have decided to present to Sir Andrew Noble, who has been so long connected with Elswick, the freedom of the city. An illuminated address contained in a casket, whose decorations will be emblematic of the industries of Sir Andrew's firm, is to be presented to him. At the present time the firm's affairs are in a most flourishing condition. It is reported that it is contracting for a small cruiser for the Chinese Government, while the *North Mail* states that the Brazilian Government have given an order for another battleship of the super-Dreadnought size, in addition to the *Rio de Janeiro* at present under construction at Elswick, and the *Minas Geraes* which recently left the Tyne. At the launch of a scout built for the Brazilian Government at Elswick Admiral Bacellar, the head of the Brazilian Naval Commission, said that the third vessel of the 1906 programme would be a vessel of nearly 32,000 tons and would carry twelve 14-inch guns. She must be considered as the beginning of a new programme of larger vessels, which he hoped to see built at Messrs. Armstrong's works.

Messrs. Swan, Hunter & Wigham Richardson, Ltd.—The yards of this firm are now very busy, the outstanding event of the past month being the launch of a liner. The Cunarder *Franconia* is the largest vessel excepting the *Mauretania* which has been built on the North-east Coast, being 625 ft. long overall, 72 ft. wide and has a gross tonnage of 18,000 and displacement of 25,000 tons. The work of installing the vessel, including the erection of the quadruple-expansion engines of 12,000 h.p., built by the Wallsend Slipway and Engineering Co., is now in progress. Another liner, the *Carthage*, built for the Compagnie Générale Transatlantique, has finished her trial trips and left for France. The boat is most luxuriously furnished and reflects credit on her builders.

Messrs. Palmers, Ltd.—The Jarrow firm is doing well at present. Among other work finishing is the Ellerman liner the *City of Bombay*; the installation of the triple-expansion engines, the derrick and winch system, etc., being now proceeded with. The company has obtained an order to build a large cargo steamer for the Hungarian Levant Steamship Co., Ltd., of Budapesth, and the work will be pushed through this year.

Messrs. Wood, Skinner & Co., Ltd.—This firm of shipbuilders at Bill Quay have been busy lately with orders for the mercantile marine. Among boats which have recently left their hands may be mentioned a vessel for the Burnett Steamship Co. and a steel screw steamer for a Christiania firm, both of which vessels have undergone their trials

successfully. Work is now proceeding on a single-deck steamer for a Copenhagen firm.

Wearside.

North-Eastern Marine Engineering Co., Ltd.—As a result of the revival in shipbuilding, this firm is again very busy. Among recent equipments may be mentioned a set of triple-expansion engines of medium power to the order of the Blyth Shipbuilding and Dry Docks Co., Ltd., for a boat built for Messrs. Sharp & Co., of Newcastle, a set of triple-expansion engines and a multitubular boiler for the *Kamma*, two boilers for 180 lbs. pressure and main engines for a vessel built for Mr. Otto Thoresen, of Christiania, and engines for the *Corbridge*, built by Messrs. Robert Thompson & Sons, Ltd.

Messrs. J. L. Thompson & Sons, Ltd.—Among other work this firm is now engaged in furnishing the steamship *Daventry*, to the order of Messrs. Sivewright, Bacon & Co., Ltd., and very good labour-saving machinery for handling cargoes, made by Messrs. George Clark, Ltd., is being installed.

Messrs. Wm. Doxford & Sons, Ltd.—Business is brisk in these yards, recent launches including that of the *Moorlands*, a 6400-ton vessel built on the single-deck principle, while the *Izabran*, a 6900-ton boat, for merchant service, has passed her full loaded trials. They have also launched the *Windsor Hall*, a vessel to the order of a Cardiff firm.

River Wear Commissioners.—The river Wear Commissioners have decided, in view of the increasing timber trade at South Dock, to buy more waggons. They also intend to spend about £4000 in order to convert two disused coal drops at the Hudson Dock North into a staith capable of accommodating the larger class of waggon which has now come into vogue.

THE TEES AND HARTLEPOOLS.

(From our Own Correspondent.)

Middlesbrough.

Messrs. Sir Raylton Dixon & Co., Ltd., Cleveland Dock-yard, are very busy; they have recently booked an order for two steamers of about 250 ft. length for the Mediterranean trade for Messrs. H. E. Moss, Liverpool, reported to be built under the superintendence of Messrs. Esplan & Sons, and the machinery is expected to be supplied by Messrs. Dickenson & Son, Sunderland. They expect to secure the order for a meat boat to be built for Liverpool owners for which tenders are asked.

Messrs. W. Harkess & Co. are fairly busy with work on hand, but no new orders are reported, prices keeping very low.

Messrs. Smith's Dry Dock Co., South Bank, are reported to have secured a contract to build six steamers for a Blyth Fishing Syndicate; they will also supply the machinery for the same. At present they have the P. & O. s.s. *Japan* in dry dock.

Messrs. Richardsons, Westgarth & Co. are reported to have secured the contract to supply the engines and boilers for a steamer building on the Tees. They are busy with work on hand which will occupy the remainder of this year.

Stockton and Thornaby.

Messrs. Craig, Taylor & Co. are busy with work on hand, but nothing new is reported, although they expect to secure a contract which is in the market.

Messrs. R. Ropner & Sons are reported to have secured the contract to build a cargo steamer for Messrs. R. Chapman and Sons, Newcastle-on-Tyne, to carry about 9750 tons deadweight on 26 ft. 4 in. draught; her length will be 415 ft. between perpendiculars by 55 ft. beam, for delivery in January next.

Messrs. Richardson, Duck & Co. are reported to have secured an order to build a steamer for foreign owners, and are busy with work on hand.

Messrs. Blair & Co. are reported to have secured the order to supply the engines and boilers for the steamer to be built by Messrs. R. Ropner & Sons for Messrs. R. Chapman and Sons, Newcastle. They are fairly busy with work on hand.

The Power Gas Corporation, Ltd., have secured an order for a large Mond ammonia recovery plant for the Birchenwood Colliery Co., Stoke-on-Trent. They are also making the gas plant in duplicate for 180 B.H. power double ignition engine to run at 450 revs. per minute; they are six-cylinder vertical high-speed gas engines by Messrs. E. S. Hindley and Son, Bourton, Dorset, to be fitted to a steamer 120 ft. by 22 ft. by 11 ft. 6 in., building by Messrs. J. T. Eltringham, South Shields.

West Hartlepool.

Messrs. W. Gray & Co. are reported to have secured the contract to build a single-deck cargo steamer of about 6500 tons deadweight for Greek owners, through Messrs. Vogt and Maquire, Liverpool. They have also the s.s. *Henniston* in dry dock undergoing extensive repairs. Both yards are now very busy.

The Central Marine Engine Works are very busy and will supply the engines and boilers for the steamer to be built by Messrs. W. Gray & Co.

Messrs. Irvine's Shipbuilding & Dry Dock Co., Harbour Yard, are very busy preparing to put down a duplicate steamer to the one ready for launching for Leith owners. They are also very busy in the dry dock department.

Hartlepool.

Messrs. Richardsons, Westgarth & Co., Ltd., are very busy with work on hand. They have recently supplied the machinery to the t.s.s. *Indrabarah*, which ran 14 knots on trial, being 1·5 knots in excess of her guarantee speed. They have secured the contract to supply the engines and boilers for a steamer to be built for foreign owners of about 1200 i.h.p., to be built by Messrs. Irvine's Shipbuilding & Dry Dock Co.

Messrs. Irvine's Shipbuilding & Dry Dock Co., Ltd., Middleton, are reported to have secured the contract to build a cargo steamer of about 5500 tons deadweight to the order of J. A. A. Van Meel, Rotterdam. They are also busy with work on hand and in the dry dock departments. They have recently opened an office at 33, Bucklesbury, London, to facilitate business.

The s.s. *John Coverdale*, belonging to Messrs. J. Coverdale and Sons, of West Hartlepool has been sold to Messrs. Maclay and McIntyre, of Glasgow, for about £14,500.

The s.s. *Phyllis* belonging to the Seaton Steamship Co., (Messrs. Allison & Hogg) has been sold to Captain Ambatic Co., Constantinople, through Messrs. Tapps & Kirby for about £5750.

THE HUMBER AND DISTRICT.

(From our Own Correspondent.)

Messrs. Amos & Smith, engineers and boilermakers, have not booked any fresh orders during the month, but they are still running their night shift to complete orders in hand, which consist of general trawlers for Grimsby and Hull, also machinery and boilers for new steamers for the Wilson line. Their branch shop situated at Alexandra Dock is very well employed with repair work and dry-docking of steamers; the Albert Dock outside staff is also busy with repair work. Enquiries from foreign and English steamship companies for their patent steam and hand-steering gears have been received.

Messrs. Stewart & Craig, engineers and boilermakers, have had a considerable amount of general repairs, and dry dock work, including the following steamers:—s.s. *Aagot*, gone through Lloyd's survey, s.s. *Maningham*, very heavy repairs, and new tail and crank shafts supplied and fitted; s.s. *Royal*, *Bara*, *Sigyn*, *Rodney*, etc., general engine-room and deck repairs.

North-East Coast Engineering Works have had a fairly good month with repair work. The s.s. *Trojan Prince* (Prince Line) has been dry docked, cleaned, painted, etc., and fairly large repairs to deck, engine-room and boilers. Other steamers have been in for repairs and the s.s. *Labuna* has had new condenser doors fitted.

Mr. Thomas Tate, engineer and boilermaker, has been fairly busy amongst small craft and mill work, and has also done the deck and engine-room repairs on s.s. *Benhead*.

Messrs. Cooper & Co., engineers and boilermakers, have had a fairly good month. The Neptune Engine Works have been busy finishing up repair work, etc. The moulding department are busy with foreign and English orders for propellers. The branch shop at Alexandra Dock has had a number of steamers undergoing repairs, and also several dry docked for survey and painting.

Messrs. Cochrane & Sons, shipbuilders, Selby, have several trawlers and drifters in frame and about launching, but no fresh enquiries.

Messrs. Cook, Welton & Gemmell, shipbuilders, Beverley.—This old-established yard is far from being busy. Several steam trawlers are on stocks in frame and about launching, and others fitting out.

Messrs. The Tilbury Contracting & Dredging Co.—This firm has now taken possession of the Humber Ironworks,

patent slip, shops, yard and foreshore, river front and yard lately in the occupation of Messrs. Cook, Welton & Gemmell, shipbuilders. It is stated that they will build dredgers, repair hoppers, etc. The Corporation has given a contract to the firm to clear away a heavy cranch of sand and mud from the entrance to the old harbour, which is greatly used by small craft, such as keels and barges, carrying the grain, and Soya bean cargoes from the docks to the mills studded along the harbour sides. I am also given to understand that this Dredging Co. has been successful in obtaining the contract at Southampton to dredge 500,000 cubic yards of mud, etc.

Messrs. Earle's Shipbuilding & Engineering Co., Ltd., have just finished the s.s. *Darlington*. Her trial trips were successful with a speed of 15 knots to her credit. She is well fitted up for passengers, and the owners, Messrs. Wilson and North-Eastern Railway Co., have to be congratulated on such a well appointed steamer for the Hamburg trade. With such fine steamers as the s.s. *Hull*, s.s. *York*, and s.s. *Darlington* we expect to see the passenger trade reviving again. We are glad to report that the Wilson Line has placed a contract with this eminent firm for a first-class passenger steamer 330 ft. with a speed of 15 knots, for their Swedish mail service, to run between Hull and Gothenburg. The Company has also secured the order to build machinery and boilers for two coasting steamers. The s.s. *Hornsea*, of Hull, has undergone very extensive repairs on hull and machinery, and several large steamers have been dry docked and put through Lloyd's survey.

Messrs. The Hull Central Dry Dock & Engineering Co., Ltd.—This company is keeping fairly busy. The s.s. *Olympic*, of Hull, has been in the Central Docks for about five weeks undergoing the removal and partial renewing of nearly 100 plates (shell) and floors, having been ashore in the Baltic. They have also dry docked several steamers in the Alexandra and Albert Docks, *viz.*, s.s. *Airmyn*, s.s. *Middleton*, both grounding damage; s.s. *Belgique*, broken stem renewed and forward grounding damage; also undergoing deck and engine-room repairs. Other jobs have included s.s. *Adriatic*, s.s. *Atlantic*, s.s. *Pass*, s.s. *Ryton* and two L. & Y. Railway steamers.

Messrs. Woodall & Co., engineers and boilermakers, are fully employed, having been entrusted with a large amount of repair work on the following steamers:—s.s. *Halga*, engine-room and windlass; s.s. *Lemas*, deck repairs, etc.; s.s. *Alfa*, engine-room repairs; s.s. *Madvig*, s.s. *Fyen*, deck and engine-room. Foreign and English companies' orders are keeping the staff fully employed with their Handibloc and heavy purchasing gear, and outside staff are always fully employed at the Corporation trams, boilers and machinery department.

Coal Trade of Hull.—The quantity dealt with at Hull in July last constitutes the second best recorded. The total amount received in port was 627,024 tons, compared with July, 1899, when 562,224 tons were received; this gives an increase of 64,800 tons. In July, 1908, 525,186 tons were received, and in July, 1907, 656,272 tons, being the largest quantity ever received. The total for the seven months of the present year reached 3,925,904 tons, which, compared with 3,268,288 tons for the previous year, gives an increase of 657,616 tons. The previous best seven months was in 1907, the figures then being 3,569,920 tons, thus the increase for the current year over 1907 is 355,984 tons. The foreign exports for July, 1909, come second to July, 1907, but for the seven months the present year takes the first position. The total export tonnage for July amounted to 411,717 tons, against 344,970 tons last year, 300,558 tons in 1908 and 435,135 tons in 1907. For the current year 2,154,215 tons have been exported, against 1,669,786 tons last year, 1,550,801 tons in 1908, and 1,776,800 tons in 1907. The coastwise exports during July amounted to 77,806 tons, against 75,117 tons in 1909, 51,016 tons in 1908, and 120,577 tons in 1907. For the seven months of the current year these exports reached 557,120 tons, against 485,949 tons in 1909, an increase of 71,171 tons. Out of this total London alone took 365,856 tons.

SOUTH OF ENGLAND AND ISLE OF WIGHT.

(From our own Correspondent.)

Messrs. J. Samuel White & Co., Ltd., East Cowes.—H.M.S. *Harpy*, ocean-going destroyer, was handed over to the Admiralty on July 28th, several weeks before the contract time, which expired on the 26th of this month. H.M.S. *Basilisk*, sister vessel to above, finished her trials last month, and is completing for handing over.

Messrs. Day, Summers & Co., Ltd., Northam Iron Works, have just handed over to the Liebig's Meat Co. the s.s. *Don Carlos*, and the vessel sailed last month for South America after successful trials. The Government vessels *Grappler* and *Elizabeth* are at the yard undergoing extensive overhaul. The steam yacht *Lady Evelyn* is also at the yard for a refit. The steam yacht *Alberta*, formerly the property of the late King of the Belgians, is also in hand for overhaul. The steam yacht *Tuscarora* is going through survey, and the s.y. *Kawala* is refitting, whilst the yacht *Francesca* is being re-coppered. The firm are also engaged on three turrets for instructional purposes for Portsmouth, Chatham and Devonport dockyards respectively, these turrets being similar to the two built and erected by the firm at Whale Island a few years ago. The coal elevator handed over to owners some weeks ago has been towed round to London to work that port, and in spite of heavy weather proved herself an excellent sea boat.

New Services.—Arrangements have been completed for the vessels of the Thomson Line to sail monthly from Southampton *en route* for Montreal. The s.s. *Tortona* called here on the 20th of last month to inaugurate this new service, and should the traffic warrant it, the service will be accelerated and be made a fortnightly one.

The *Tortona* has accommodation for about fifty first and 1000 third-class passengers. She is a finely modelled four-masted twin-screw steamer, 464 ft. long, 54 ft. 2 in. beam, with a gross tonnage of 7600, and a deadweight carrying capacity of 8300 tons. A large number of guests were invited by the owners to inspect the vessel previous to departure.

The Union Castle Co. have decided to maintain a monthly service from this port *via* the Canal to the British East African possessions. The service will be maintained by the "G" steamers of the Co.'s fleet. The s.s. *Guelph* will commence the service, sailing from this port on the 14th of this month. She will load at Middlesbrough, London and Antwerp, and sail finally from Southampton. She will call at the principal East African ports, and join up with the Co.'s mail service at Natal. Passengers leaving Southampton by the *Guelph* could by transferring to the mail steamer at Natal complete the circumnavigation of the Continent, and arrive here about the 19th November, a little over two months being occupied by the round voyage.

Firemen's Strike.—A strike occurred here last month among the firemen of the White Star Line, the men demanding an increase in pay of 10s. per month, in consideration of the extra work involved owing to the incapacity of men recruited on the other side, which necessitated extra work for the regular men, who did not receive additional pay. The object of the strikers was to prevent the sailing of the *Adriatic*, but owing to precautions taken by the police and to arrangements made by the Company for substitutes, this object was frustrated. The steamer left the docks exactly to time, the engineers acting as firemen until the vessel was between Cowes and Portsmouth, when a full complement of firemen was taken aboard from the steamer *Duchess of Edinburgh*. It is understood that the matters in dispute have now been settled.

The Dutch steamer *Hollandia* arrived in the docks at Southampton about the middle of last month with a twisted stem due to collision with a vessel off the Casquets, which was beached to prevent her sinking. After discharging part cargo the *Hollandia* proceeded into No. 3 dry dock for examination and repair. The stem bar was broken, and bent round at right angles on the starboard side for about 25 ft. of its length, and the plates were buckled and bent on both bows. The *Hollandia* is a twin-screw steamer of 7291 tons gross and was built by Messrs. A. Stephens & Sons, Ltd., Glasgow, in 1909. She is 419 ft. 7 in. long, beam 54 ft. 2 in. and depth 34 ft. 4 in. The owners are the Koninklijke Hollandsche Lloyds, Amsterdam.

Messrs. J. I. Thornycroft & Co., Ltd., Woolston Works, Southampton, handed over H.M.S. torpedo boat destroyer *Savage* on the 18th of last month after satisfactory trials, a month before the contract date. H.M. ships *Larne*, *Lyra*, *Martin* and *Minstrel*.—Good progress has been made with these vessels, the water testing of the hull of the *Larne* being

completed last month. The turbines and shafting have all been shipped, the propellers fitted and the vessel was launched on the 23rd of last month. H.M.S. *Acheron* and *Ariel*.—The two special destroyers ordered from the firm for this year's programme are to be named as above. A start has been made on the frame turning. Firefloat *Gamma*.—The hull of this vessel was water-tested last month. 80 ft. Sternwheel Sawmill Steamer.—This vessel was launched on the 9th of August, and a preliminary steam trial underweigh was completed on the 18th. The official trials were being run at the end of last month. Paddle Steamer *Arabia*.—The framing of this vessel is now completed, and the keel of the motor tank barge to be named the *Rocklight of London* is laid, and the framing erected. The framing of three 63 ft. motor boats is completed and a start has been made with the frame turning for the twin-screw yacht on order. The shops and repairs department have been fully employed during last month.

THAMES.

(*From our Own Correspondent.*)

The Port of London Bill.—This measure in two divisions, one the Port of London (Registration of Craft) Provisional Order confirmation and the other the Port of London (Port Rate on Goods Provisional Order) have passed through both Houses of Parliament, and received the Royal assent. Such a result was not attained, however, without a more or less difficult passage. There was considerable discussion on the third reading in the House of Commons and the excuse made was that the accounts of the Port Authority had not been published. The riverside interests fought too to fix a limiting figure for the charges upon their traffic, but the proposal was defeated. The Midland manufacturers also did their utmost to bring about an adjournment. Before the Select Committee of the House of Lords, a statement of the position was made by the chairman of the Port Authority, who was clear against any appeal upon charges made by them being permitted to the Board of Trade, and the full responsibility was claimed by the authority with which Parliament had entrusted it. The petitioners against the rates were the City Corporation and the waterside manufacturers, but in the end the provisional order which gives an income of £330,000 on the dock and river charges with an elasticity margin of up to £484,500 was agreed to, with the recommendation that though no reduction was allowed on the charges for meat and other articles of food brought into the port, yet the most favourable consideration of these articles was asked for by the Port Authority with the powers invested in that body. It is interesting to know that shipowners, as represented by the General Shipowners' Society, by their annual report show that they have been actively engaged during the year in removing any objections they had to this bill and that as passed all differences have been satisfactorily adjusted. The secretary of this body, Mr. W. H. Cooke, is resigning after thirty years' service.

The Union Castle Line.—We have to report a very distinct advance by this Company, no less than the inauguration of a new service *via* the Suez Canal along the East Coast of Africa. The Company has hitherto gone as far north as Mombasa *via* the Cape, but the route is necessarily long. The new service will commence on September 14th by the first of a four-weekly service of passenger and cargo steamers. The vessels will call at Marseilles and Naples and proceed from Suez, with perhaps a call at Aden, to Mombasa. Passengers will thus be able to reach British East Africa from London *via* Marseilles in eighteen or nineteen days. These steamers will then proceed as far south as Durban, and communication will thus be made with Tanga, Zanzibar, Dar-es-Salaam, Mozambique, Chinde, Beira and Delagoa Bay. The steamers to be employed are of the modern intermediate type, the *Guelph*, of 5000 tons, being the first to inaugurate the sailings. The service is such that a passenger can circumnavigate Africa by this line in about two months by changing at Durban into the West Coast steamers.

Council Steamboats Accounts.—We are reminded by a recent report of the Finance Committee of the London County Council that this matter is not ended yet, there being a debt on March 31st of £214,625, made up of £147,369 on boats and £67,256 on piers. There is a deficiency for the year in the revenue account under this head of £35,500, and it was accordingly recommended that this amount be charged to the general county account.

St. Paul's Bridge.—There is a deadlock in the negotiations proceeding on this matter, but on a question being asked at the Corporation meeting it was said that no difficulty was anticipated with regard to the proposals respecting Southwark Bridge, but as regards the new St. Paul's Bridge there was a disagreement at the moment with the London County Council, who were asked to make a contribution to the cost of the northern approach. In the end the committee of the Corporation promise a report after the vacation, the Chairman saying they may decide to go to Parliament without the County Council at all.

H.M.S. "Worcester"—The annual inspection and prize-giving took place this year in glorious weather, the number of visitors being larger than usual. Admiral Sir E. Fremantle presided, and Lady Gorell gave the prizes away. The King announced his intention of presenting the medal which was instituted by Queen Victoria and continued by the late King. Lord Gorell also delivered an address, and in his judicial capacity for so many years in the Admiralty Court he was able to speak of the qualities necessary to make a good commander and give freedom from accidents. Mention was made of the positions taken by previous cadets and a reference followed to Admiral Togo as being an old pupil.

MERSEY AND MANCHESTER SHIP CANAL.

(*From our Own Correspondent.*)

LIVERPOOL has had many rivals and imitators due to its great success as a port, shipping and commercial centre. It is, however, keenly alive to the maintenance of its position. Preliminary work has been commenced upon the new dock extension, while no less than three new ferry steamers have recently been added to the Mersey fleet, the *Storeton* having been put on the Birkenhead service while the *Bluebell* and *Snowdrop* are now employed on the Wallasey system.

Messrs. Cammell, Laird & Co.—One striking feature about the work turned out by this firm is the large variety of work and the various nationality of its clients. The British destroyers *Renard*, *Wolverine* and *Racoon* have all completed very successful trials, having exceeded the 27 knots contract, the coal consumption has also been very satisfactory. The two new destroyers recently ordered are being pushed forward rapidly, while orders have been received for two small vessels to act as tenders to the submarine depot ship which is to be built by "Scott's" of Greenock. The machinery for H.M.S. *Blonde* is partly on board, and it is expected that this vessel, sister ship to the *Blanche*, will be ready for trial about the new year. The large floating dock is making rapid progress, the lower part of the huge structure being well advanced. The four destroyers for the Argentine have been named after various districts of that country. The special turbine machinery for these vessels is well forward, and it is expected that these boats will uphold the Birkenhead firm's name for light high-speed craft. The *Bluebell*, the first of the Wallasey ferry steamers, had a preliminary trial on August 13th and ran her official trial on the 16th ult., when she exceeded her contract speed and proved herself to be an excellent sea boat. On this occasion Mr. John Sayce, J.P., chairman of the Ferries Committee, said that 30,000,000 passengers would be carried shortly, while another speaker hinted that the next boats would be driven by petroleum engines. The *Bluebell* attained an average speed of 12 knots. The *Snowdrop* ferry steamer, sister to the *Bluebell*, is now fitting out after launch, and will shortly follow her sister ship on the service. The tug boat *Heracles*, also the meat barge *La Blanca*, have left for their destinations, the former under her own steam. Her speed will be 11¾ knots. The Nelson liner *Highland Brae* was launched from the Tranmer yard on August 6th, the date having been altered. The *Caesarea* is now ready for trial and the sister ship *Sarnia* also for the L. & S.W. Railway will shortly be ready. The repair department have been busy with the usual overhaul and refit work. Orders have been received for two stern-wheel steamers through London agents, this firm having turned out many boats of this class. The first of three handy steamers for service on the Amazon River is nearing completion. She

has been named *Sertanejo*. These vessels are 150 ft. long and are fitted with a single screw, they will have deck houses on the awning deck and will also have a boat deck. The order for these boats was placed by Messrs. Singlehurst, of Liverpool, for foreign owners.

Messrs. H. & C. Grayson have had their yards busy with general repair work. Two new tenders for the Mersey Towing Co. are rapidly being constructed at the Garston yard. They have again had the docking of the Brazilian battleship *Sao Paulo* in the Canada Dock. The whole of the bottom has been covered with Holzapfel's navy brand anti-fouling composition. She being now completed her appearance is very striking with her twelve 12-inch guns. Her hull is painted white while her under part is of olive green. She was expected to be handed over to the Brazilian Government about August 23rd, when she will complete coal stores, etc., and is expected to sail about September 15th. Her full complement is 1100 men. Eight guarantee engineers will sail with her, the first port of call being Lisbon, where she will embark Marshall Kermes da Fonsica, President-elect of the Brazils. Brazil already possesses the two most powerful battleships afloat, and the third now building, the *Rio de Janeiro*, will be 32,000 tons and will have twelve 14-inch guns.

Messrs. Clover, Clayton & Co. have their hands full just now with work on both sides of the river. The Ellerman liner *Assiout* is in for overhaul, while the *Nicholas* is in for engine repair and grounding damage. A large overhaul contract, the Brocklebank steamer *Montgomeryshire*, is in hand, also the *Ardover*. The steamer *Gokstad* is also shortly expected.

Mersey Dock and Harbour Board.—At a recent weekly meeting of this board it was intimated that at a court of the Corporation of Trinity House held on August 2nd, the marine surveyor and water bailiff to the Dock Board, Lieut. T. W. Mace, had been duly elected a Younger Brother of that corporation.

Allan Line.—This progressive Company have opened new offices at 14, Cockspur Street, London. The new premises will be luxuriously appointed and will contain 1st, 2nd and 3rd-class passenger sections, directors' rooms, etc. This is part of the new development scheme at whose head is the able chairman of the Company, Mr. Hugh A. Allan, another feature of this forward policy being the construction of vessels of 700 ft. of 23,000 tons and 22 knots speed, and it is appropriate that the needs of the All Red Route should be anticipated by the oldest line in the service.

Messrs. John Holt & Co.—Messrs. Hamilton, of Port Glasgow, have recently launched for this Company a steamer for the West African trade; length 269 ft. 6 in., beam 38 ft., depth 18 ft. 3 in. This vessel is built on the Isherwood system, is rigged as a fore and aft schooner; raised forecastle and poop, also deck houses are provided. The engines are triple-expansion.

Mr. Charles Cadman.—The death occurred on August 19th of Mr. Charles Cadman in his 67th year. For forty years Mr. Cadman had acted as superintendent-engineer to Messrs. T. & S. Harrison. Previously he was assistant superintendent to the National Line of steamers. Amongst many improvements in marine engineering may be mentioned the Cadman lubricator.

White Star Line.—The training ship *Mersey* sailed on July 28th on her third voyage to Adelaide, Melbourne and Sydney. This boat is now fitted with electric light and the Marconi system of wireless telegraphy.

Training Ship "Conway."—The annual prize distribution took place on July 27th, Major Goold Adams making the presentations. This gentleman is an old *Conway* boy and was with Baden Powell in Mafeking, and attributes much of his fitness in difficulties to his early training.

NORTH-WEST OF ENGLAND.

(From our Own Correspondent.)

Messrs. Vickers' Works.—During the month there has been very little of moment. The Brazilian battleship has now left Barrow and was again dry docked in the Mersey. At present she is lying in the Clyde where she is taking on stores and crew, the latter being transferred direct from the transport. The *Sao Paulo* presented a very fine sight when she left the port and was a great contrast to the dull grey of the warships of this country.

The cruiser *Liverpool* has been completed and she left before the end of the month. Her appearance is much improved by the adding of 6 ft. to the funnels. All vessels of this class will be similarly altered. The sister ship, the *Dartmouth*, is growing on the stocks, but a few months will elapse before she is launched. The floating dock for Aberdeen is shaping now, and it will not be long before it is off and taken round the coast to Aberdeen. This dock is for the steam trawlers and will be capable of lifting two of the largest type at once. Probably the next launch will be that of the Brazilian tugboat which it is hoped to get ready in order to proceed to Rio Janeiro before the turn of the weather. It was said at one time that this tug would be ready in time to assist in the towing of the battleship floating dock to Rio, but this is a separate contract altogether. The floating dock is well on its way now and was last spoken "All well." The two powerful Dutch tugs *Nordzee* and *Roodezee* seem to be making a fine passage, and the accomplishment of this great task without accident will be a great achievement, both as an advertisement and also from a monetary point of view.

"**Princess Royal.**"—Work is proceeding apace with the construction of the battleship cruiser *Princess Royal*, but it will be several months before she is ready to take the water. She will be a record weight when she does. The sister ship *Lion* was launched a short time ago at Devonport, but her weight was only a matter of 8000. The *Vanguard*, which was launched at Barrow with only some 19,000 tonnage, was 10,000 tons deadweight when she was launched. The propelling machinery for the *Lion* is well forward and delivery of same commences immediately. That of the *Princess Royal* will not be far behind, and it will be a wonder if in the end Messrs. Vickers, although apparently behind the dockyard, do not get their boat out first. It all depends. At present the air is not quite clear of labour troubles, which it is hoped will be overcome without men having reverted to striking—an obsolete method now.

There are a lot of rumours regarding orders for Messrs. Vickers for cross-Atlantic vessels, but at present there is not a single peg to hang a true statement on—and yet one is hopeful of Messrs. Vickers getting into this work. When they do they will make their mark.

BELFAST.

(From our Own Correspondent.)

Messrs. Harland & Wolff have completed and sent to sea the twin-screw steamer *Pakeha*, which they have built to the order of the Shaw, Savill & Albion Co., Ltd., for their New Zealand trade. The vessel is 500 ft. long, by 63 ft. beam, with a gross tonnage of about 8000 and, in addition to large cargo capacity, she has comfortable accommodation for a number of passengers. The propelling machinery consists of two sets of quadruple-expansion engines. The next vessel to leave these builders' hands will be the Bibby liner *Gloucestershire*, which was launched in July. Work is being pushed on night and day at the two big White Star boats, the first of which, the *Titanic*, will be launched in October, with the *Olympic* to follow in May next.

The news that the Right Hon. A. M. Carlisle is about to retire from his position as general manager and chairman of managing directors of Messrs. Harland & Wolff has been received with surprise and regret. Mr. Carlisle has been connected with the great shipbuilding concern for forty years, and for the greater portion of the time he has been in a position of such prominence that his presence will be missed in no small degree. In the days of Mr. Carlisle's apprenticeship with the firm, the building of a 3000-ton steamer was justly looked upon as a big feat, whereas he now looks down from the "top of the tree" upon the crown of his business labours, the building of the great White Star liners, with a tonnage of 45,000 tons each. Speaking of his apprenticeship, it is worthy of note that "Alick," as he was then called, gained the rare gold watch presented by the firm to an apprentice who had never lost an hour. Continuous progress in one concern, from apprentice to the very highest post, and to the dignity of Right Honourable, is a record of which any man might be justly proud, but which has never rendered Mr. Carlisle inaccessible to, or unapproachable by, any of the thousands who served under him.

Messrs. Workman, Clark & Co. recently had a successful trial trip with the new Bucknal Line steamer *Kansas*, a vessel 440 ft. long with a gross tonnage of 7074. She has large cargo capacity, and her hatches are of the biggest possible dimensions to facilitate the loading and discharging of such cargo as locomotives, boilers, etc. Before these notes are published they will have launched a large steamer named *Æneas*, which they are constructing to the order of Messrs. Alfred Holt & Co., for which firm they have already built a number of steamers. Amongst other notable vessels at present being built by Messrs. Workman, Clark & Co. may be mentioned a twin-screw steamer for the British India Co.

Repairs.—This class of work has been fairly brisk within the past two or three months. Messrs. Harland & Wolff have completed extensive overhaul and repairs to the Elder Dempster liners *Leopoldville* and *Port Henderson*. The former vessel was built at the Queen's Island. Messrs. Workman, Clark & Co. recently carried out extensive damage repairs to the Houlder Line's *Urmston Grange*, and at the present time they have the Holt liner *Agamemnon* in dry dock with big bottom damage received by stranding on the County Down coast. Messrs. MacColl & Co. have also executed a considerable amount of ship and engine repairs within the past month.

Harbour Works.—It is expected that the big new graving dock will be ready for use shortly. The dock itself has, in fact, been completed, but the surrounding works—power station, etc.—are not yet finished. The Harbour Commissioners have decided to proceed immediately with the dredging of the embayment opposite the wharf northward of the new graving dock to a depth of 23 ft. at ordinary low-water, at an estimated cost of £5020; and, to facilitate the turning of vessels of large dimensions, it has been decided to excavate an embayment at the south end of the West Twin Island, opposite the entrance to the new dock, at an estimated cost of £9300.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Thistletor.—On July 6th, Messrs. Irvine's Shipbuilding and Dry Docks Co., Ltd., launched from their Middleton shipyard, Hartlepool, the steel screw steamer *Thistletor*, built to the order of Messrs. Allan, Black & Co. (The Albyn Line, Ltd.), Sunderland. The vessel is 382 ft. 6 in. in length by 51 ft. 4½ in. beam, 26 ft. 6 in. depth moulded, carrying 7,430 tons on a light draught, and she takes Lloyd's highest class, single deck type, with poop, and combined bridge and forecastle, and clear holds. Cellular double bottom is arranged throughout, with large fore and after peak tanks for water ballast. She is constructed with deep frames and longitudinal stringers, and divided into seven watertight compartments by means of six watertight bulkheads. Wood grain divisions throughout holds according to the latest Board of Trade requirements. Four extra large hatches are provided, with large hatch on poop and cross bunker hatch, and there are eight powerful steam winches worked from a 10 ft. by 10 ft. multitubular donkey boiler working at 100 lbs. pressure, and all the latest improvements are included to facilitate rapid loading and discharging. A powerful quick warping steam windlass is fitted forward, steam steering gear amidships, patent oil brake and hand screw gear aft. The lighting, ventilating and sanitary arrangements have received special attention, the most improved methods being adopted throughout. Triple-expansion engines will be supplied and fitted by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, the sizes of the cylinders being 25 in., 40 in., 68 in. by 48 in. stroke, with two large single-ended boilers working at 180 lbs. pressure per square inch.

Lingfield.—On July 7th, the s.s. *Lingfield* was launched from the Harbour Dockyard of Messrs. Irvine's Shipbuilding and Dry Docks Co., Ltd., West Hartlepool, where she has been built to the order of Messrs. Woods, Tylor & Brown (The Woodfield S.S. Co., Ltd.), London. The vessel is of the single deck type, with poop, long bridge and forecastle, and has a carrying capacity of 7,250 tons on a light draught. Her dimensions are 380 ft. by 51 ft. 4½ in. by 28 ft. 4½ in., depth moulded, classed Lloyd's 100 A1, and is constructed with deep bulb angle frames and longitudinal stringers, giving clear holds for the storage of bulky cargoes. Cellular double bottom is arranged throughout, and large fore and after peak tanks are provided for water ballast. Steel grain divisions are fitted throughout the holds and wood shifting boards in way of hatches to the latest Board of Trade regulations, for grain cargoes. Four extra large cargo hatches are provided, with nine powerful steam winches worked from a large multitubular donkey boiler, fitted in a house in the casing placed on upper deck and all the latest improvements are included for the rapid handling of cargo. A powerful quick warping steam windlass is fitted forward, steam steering gear amidships, hand screw gear aft, and a steam ash hoist will also be fitted. The Captain, officers and engineers will be berthed in large deckhouses on the bridge deck, and the crew and firemen in the poop, special attention having been given to the efficient lighting, ventilating, and sanitary arrangements. The propelling machinery will be fitted by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, having cylinders 26 in., 42½ in., 70 in. by 48 in. stroke, with three large boilers working at a pressure of 180 lbs.

Kendal Castle.—On July 7th, Messrs. Short Brothers, Ltd., launched from their shipyard at Pallion, Sunderland, the s.s. *Kendal Castle*, built to the order of Messrs. James Chambers & Co., for the Lancashire Shipping Co., Ltd., of Liverpool. She is a single deck vessel, with cargo poop, and bridge and topgallant forecastle, built to the Isherwood system of longitudinal framing, and will take Lloyd's highest class. Her leading dimensions are:—Length, 363 feet; beam, 50 feet; and depth moulded, 28 feet 1¾ in., and she is designed to carry a large deadweight on a moderate draught. Cellular double bottom is fitted; all fore and aft and both peaks are arranged for water ballast. Eight steam winches, steam windlass, steam steering gear fitted in engine-room and controlled from standard on flying bridge and connected by steel wire to quadrant aft, with hand steering gear aft, are fitted. Eight derricks are provided to main hatches worked from strong tables on masts, and the cross bunker hatch is worked by two derricks swung from Samson posts, which are also to act as wing ventilators to stokehold. The holds are specially arranged to be as far as possible clear of obstruction to permit of large pieces of machinery being shipped. The propelling machinery will be fitted by Messrs. George Clark, Ltd., of Sunderland, and consists of triple-expansion engines with cylinders 25 in., 41 in., 68 in. diameter and a stroke of 45 inches, taking steam from three large multitubular boilers working at 180 lbs. pressure, fitted with Howden's system of forced draught. The model of ship and engines have been designed with a view to economical working, and it is expected that the vessel will readily maintain a sea speed of 10 knots.

Prince Victor.—On July 7th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 115 ft. by 21 ft. 6 in. by 12 ft. 3 in. moulded. The vessel has been built to the order of H. Bernstein, Esq., of Grimsby, and will be fitted with powerful triple-expansion engines by Messrs. C. D. Holmes & Co., Ltd., of Hull, and is replete with all the latest improvements for fishing purposes.

Ellerbeck.—On July 7th, Messrs. The Blyth Shipbuilding and Dry Docks Company, Ltd., launched from their shipbuilding and graving docks works the fine steel screw steamer *Ellerbeck*, built to the order of Messrs. Sharp & Co., of Newcastle-on-Tyne. This vessel, which measures 255 feet in length, with a beam of 36 ft. 9 in., has been constructed under Lloyd's special survey for their highest class. She is of the raised quarter-deck type, having short bridge and topgallant forecastle. The *Ellerbeck* is specially adapted for the coal and wood trade, having specially large self-trimming hatches and clear holds, together with the best and latest design of deck machinery, including eight cargo winches, for the quick and economic working of the cargo. Triple-expansion engines of good power will be supplied by Messrs. The North Eastern Marine Engineering Co., Ltd., of Sunderland.

Grain Barge.—On July 8th, Messrs. Smith's Dock Company (Limited) launched, at Middlesbrough, a steel steam twin-screw grain barge.

Sarnia.—On July 9th, there was launched at Birkenhead the triple-screw turbine steamer *Sarnia*, which has been built to the order of the London & South-Western Railway Company for their Channel Island traffic. The *Sarnia* is 284 ft. long on the water-line, 39 ft. broad, and 16 ft. 6 ins. deep

to main deck. She has accommodation for 186 first-class passengers, 114 second-class, and a crew of 48. When completed the vessel will be representative of all that is best in a cross-Channel combined passenger and cargo steamer. The propelling machinery consists of two double-ended marine boilers and a set of Parson's turbines driving three shafts, and designed to give the vessel a service speed of 20 knots.

Brittany.—On July 9th, there was launched at Hull a single screw steamer which is being built to the order of the London, Brighton & South Coast Railway Company for their trade between Newhaven and Caen. The principal dimensions are :—Length, 192 ft. ; breadth, 29 ft. ; and depth, 15 ft. The vessel has been constructed of steel to Lloyd's 100 A1 class, for Channel service, and to Board of Trade latest requirements. She is of the single-deck type, with bridge and topgallant forecastle. A feature of the vessel's equipment is the refrigerating plant, which is of the most up-to-date type. The main hold is fitted up as an insulated chamber and has a capacity of about 6,500 cubic feet. The vessel is fitted throughout with a complete electric lighting installation, and is provided with a powerful searchlight on the forecastle deck for use in passing through canals. The machinery consists of one set of triple-expansion engines, with cylinders 15½ in., 25 in. and 40 in. diameter by 27 in. stroke. Steam will be supplied at a pressure of 160 lb. per square inch by two cylindrical boilers. The machinery throughout is of the highest class, and of sufficient power to propel the vessel at a speed of 12 knots per hour.

Benpark.—On July 9th, Messrs. Craig, Taylor & Co., Ltd., launched from their Thornaby shipbuilding yard, Stockton-on-Tees, a finely modelled steel screw steamer to carry about 70 tons deadweight on a light draught of water. The owners, Messrs. Joseph Hoult & Co., Ltd., of Liverpool, were represented at the launch by Mr. B. Allen, of Liverpool, under whose superintendence the vessel has been built.

Corbridge.—On July 13th, Messrs. Robert Thompson and Sons, Ltd., launched from their Southwick yard, a first-class cargo steamer, built to the order of Messrs. James Hoggarth and Co., Cardiff, and the second vessel they have built for this firm. The principal dimensions are :—Length, B.P., 350 ft. ; breadth, 50 ft. ; and depth moulded, 25 ft. 10 in. She will be classed 100 A1 at Lloyd's, under special survey, and is constructed with single deck, and designed to carry a large deadweight cargo on a light draught. Ample water ballast is provided in the cellular bottom and after peak. Full cargo poop and bridge are fitted. There are five cargo hatchways with double derricks fitted on tables and cross-trees at masthead, also derrick posts to bridge hatches, worked by eight powerful steam winches, and a large multitubular donkey boiler of ample capacity for the supply of steam to the deck machinery, steam windlass and steam steering gear. The engines, by Messrs. The North-Eastern Marine Engineering Co., Ltd., Sunderland, have cylinders 25 in., 42 in., and 68 in., with a stroke of 45 in., steam being supplied by large boilers working at a pressure of 180 lbs. per square inch.

Daventry.—On July 21st, this vessel was launched from the North Sands Shipbuilding Yard, Sunderland, by Messrs. Joseph L. Thompson & Sons, Ltd., having been specially constructed to the order of Messrs. Sivewright, Bacon & Co., of Manchester, and is the sixth vessel Messrs. Thompson have built for this firm. The principal dimensions of the vessel are : Length, 367 ft. 3 in. by breadth extreme 50 ft. 11 in. by depth moulded 27 ft. 4 in. The vessel has been constructed to Lloyd's highest class, under their special survey, the upper deck being fully laid and the main deck for about half length. A poop, bridge and topgallant forecastle are also fitted. The vessel is very finely modelled, and is designed to have a large cubical and deadweight capacity on a very moderate draught of water. The deck machinery and gear for the rapid handling of cargoes will be quite up-to-date. The machinery has been constructed by Messrs. George Clark, Ltd., of Sunderland, the sizes of the cylinders being 25 in., 41 in., 68 in. by 48 in. stroke, supplied with steam by three large boilers working at 180 lbs. pressure.

Windsor Hall.—On July 21st, Messrs. Wm. Doxford & Sons, Ltd., launched from their yard at Pallion a single-deck steamer 345 ft. long, 48 ft. broad, and of 27½ ft. moulded depth, built to the order of Messrs. Edward Nicholl & Co., Cardiff. This latest addition to their fleet is named the *Windsor Hall*, and is designed to carry 6300 tons deadweight on moderate draught. The classification is with the British Corporation. The engines, with cylinders 25 in., 41 in., 66in. and 45 in. stroke, and the two boilers 15 ft. 9 in. by 10 ft. 10½ in., have also been built by Messrs. Doxford.

Dalecrest.—On July 22nd, the Northumberland Shipbuilding Co., Ltd., launched from their yard at Howdon-on-Tyne, the finely moulded steamer built to the order of Messrs. Taylor & Worthington, Liverpool, for Messrs. The Dalecrest Steamship Co., Ltd., Liverpool. The vessel is 390 ft. long by 49 ft. beam by 29 ft. deep, and has been built under special survey to the highest class at Lloyd's. She is fitted with long bridge, long poop, topgallant forecastle, the accommodation, which is very ample, being placed in steel houses on the bridge deck. The 'tween decks are lofty and so arranged that cattle, troops or emigrants may be carried if necessary. Very special attention has been paid to the leading and discharging gear, and a complete outfit for the rapid handling of cargoes arranged for consisting of eight steam winches by Messrs. Clarke, Chapman & Co., Ltd., Gateshead-on-Tyne, a large number of cargo derricks and steam windlass by Messrs. Clarke, Chapman & Co., Ltd. She is fitted with the usual water ballast arrangements for light passage. The machinery will be supplied by Messrs. Richardsons, Westgarth & Co., Ltd., Sunderland, consisting of engines with cylinders 25 in., 41 in., 69 in. by 48 in. stroke, three large steel boilers with 180 lbs. pressure. This vessel will carry about 7450 tons on a light draught and steam about 10 knots loaded at sea.

H. A. L. Russell.—On July 25th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 130 ft. by 22 ft. 6 in. by 12 ft. 7 in. moulded. The vessel has been built to the order of Messrs. Pickering & Haldane's Steam Trawling Co., Ltd., of Hull, and will be fitted with powerful triple-expansion engines by Messrs. Amos & Smith, Ltd., of Hull, and is replete with all the latest improvements for fishing purposes.

S. L. Haldane.—On July 25th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 130 ft. by 22 ft. 6 in. by 12 ft. 7 in. moulded. The vessel has been built to the order of Messrs. Pickering & Haldane's Steam Trawling Co., Ltd., of Hull, and will be fitted with powerful triple-expansion engines by Messrs. C. D. Holmes & Co., Ltd., of Hull, and is replete with all the latest improvements for fishing purposes.

Kamma.—On July 26th, a new steel screw steamer which has been built by Messrs. Wood, Skinner & Co., Ltd., of Bill Quay, Newcastle-on-Tyne, to the order of Mr. Martin Carl, of Copenhagen, was successfully launched. The vessel is of the single-deck type, with poop, long bridge and topgallant forecastle, and has water ballast provided in the cellular double bottom and fore and after-peak tanks. She has been built under Lloyd's special survey for their highest classification and is fully equipped with all the necessary appliances in the way of deck fittings and machinery to facilitate the loading and discharging of cargo with despatch. The engines have been constructed and will be fitted by Messrs. the North-Eastern Marine Engineering Co., Ltd., of Wallsend-on-Tyne, and will comprise a set of triple-expansion engines of the most improved type supplied with steam by a large steel multitubular boiler. The engines and boiler have also been built to Lloyd's requirements.

Snowdrop.—On July 27th, the ferry steamer *Snowdrop* was launched from the yard of Messrs. Cammell, Laird & Co., Ltd., Birkenhead, this being the second of the two new ferry steamers to the order of the Wallasey Urban District Council, the vessels being of the following dimensions :—Length, 160 ft ; beam, 38 ft. 6 in., and depth moulded, 11 ft. 3 in., and designed to carry about 1400 passengers. They are being handsomely fitted up and a complete system of electric lighting will be installed. They are being built to the highest class at Lloyd's for river purposes, and also in accordance with the latest rules and regulations of the Board of Trade. The whole of the machinery will be placed under the main deck, thus providing large saloon accommodation, to which special consideration has been given in regar-

to heating and ventilating arrangements in order that passengers will be provided with every comfort possible. Water tight bulkheads are fitted throughout the vessel, fore and aft and athwartships, thus making them practically unsinkable in case of collision. Over the saloon there is an extensive promenade deck, which is carried out the full length of the vessel amidships, and the overhang of the decks at the end is supported on brackets, this arrangement providing spacious accommodation and to a great extent sheltering the main deck below. Bilge keels are also fitted to avoid excessive rolling in bad weather. The machinery is being constructed by the shipbuilders, and consists of two sets of triple-expansion engines having cylinders 16 in., 24 in. and 41 in. diameter, with a stroke of 21 in., which are to be supplied with steam from two powerful boilers.

Ingstad.—On July 27th, there was launched from the yard of Messrs. R. Williamson & Son, Workington, a steel steamer called the *Ingstad* for Norwegian owners, of the following dimensions :—Length, 181 ft. 8 in ; breadth, 28 ft. 6 in., depth moulded, 14 ft. 7 in., and designed to carry 1080 tons deadweight on Lloyd's freeboard. The vessel is built to the highest class at Lloyd's and will be propelled by triple-expansion engines having cylinders 15 in., 25½ in. and 41 in. dia. by 30 in. stroke, steam being supplied by a large cylindrical steel boiler 14 ft. 6 in. dia. by 10 ft. 6 in. long, working at a pressure of 160 lbs.

George V.—There was recently launched on the Tyne a steel screw tug, which has been built to the order of Messrs. R. Redhead & Son, of Newcastle. She is 106 ft. 6 in. in length by 23 ft. beam, and has engines of 750 horse power. She is arranged with all the latest improvements for towing vessels of large size, and is equipped for long oversea towage work.

Ingleside.—On August 6th, there was launched from the yard of the Tyne Iron Shipbuilding Co., Ltd., Willington Quay-on-Tyne, a steel screw steamer built to the order of the Rowland & Marwood's Steamship Co., Ltd., of Whitby. It is interesting to note that this vessel is built on the Isherwood patent system of longitudinal framing and is the second vessel of this type to be launched on the Tyne, and marks a considerable advance in shipbuilding progress. The vessel is built to the highest class at Lloyd's and is of the following dimensions :—Length overall, about 360 ft. ; breadth extreme, 50 ft. ; depth moulded, 25 ft. 10 in. She is built under the single-deck rule with poop, bridge and forecastle. Has water ballast fitted right fore and aft on the cellular system and is also fitted with all modern improvements for the rapid loading and discharging of cargo, including eight double cylindered steam winches, direct-acting steam windlass, large multitubular donkey boiler, steam-steering gear by Messrs. Donkin & Co., with right and left-hand screw gear aft. She is fitted with double derricks to all main cargo holds and has derrick posts on bridge for dealing with the cross bunker hatch and is in all respects an exceptionally good example of the modern cargo steamer, as she carries about 6400 tons deadweight on the very light draught of 21½ ft. The engines which are to be supplied by Messrs. John Dickinson & Sons, Ltd., of Sunderland, are of the triple-expansion type, having cylinders 24 in., 40 in. and 66 in. by 45 in. stroke, with two boilers 16 ft. by 10 ft. 6 in., working at a pressure of 180 lbs. Messrs. Wailes, Dove & Co.'s " Bitumastic " Enamel was applied to the bunkers, and their " Bitumastic " Covering to boiler-room tank top.

Highland Brae.—On August 6th, there was launched at Birkenhead the steamer *Highland Brae* for the fleet of the Nelson Steam Navigation Co. The new vessel is of 8000 tons, with fine accommodation for first and second-class passengers.

LAUNCHES—Scotch.

Knight Companion.—On June 21st, a steel schooner-rigged steamer of about 7500 tons gross, named *Knight Companion*, was launched at Glasgow, the owners being the Knight Steamship Co.

Copenhagen.—On July 28th, there was launched at Port Glasgow a steel screw steamer of 4500 tons, named *Copenhagen*, which has been built to the order of Messrs. Glen & Co., Glasgow.

Highland Glen.—There was launched recently at Port Glasgow the screw passenger and cargo steamer *Highland Glen*, which has been built for Messrs. H. & W. Nelson, Liverpool and London. The gross tonnage is 7400 tons. The steamer will carry eighty first-class and thirty second-class passengers, and is installed throughout the holds for the carrying of frozen meat between Buenos Ayres and this country.

Inventor.—On August 4th, there was launched from the shipbuilding yard of Messrs. David & William Henderson and Co., Ltd., at Partick, Glasgow, a large steel screw steamer of about 8000 tons gross, which they have built to the order of Messrs. Thomas & Jas. Harrison, Liverpool. This addition to the already large fleet of vessels owned by Messrs. Harrison is 470 ft. long between perpendiculars by 58 ft. broad by 34 ft. 10 in. depth moulded, is classed in Lloyd's 100 A1 and fulfils the requirements of the Board of Trade for their passenger certificate. She is rigged as a four-masted schooner and has an exceptionally large number of powerful derricks which, with ten steam winches, provide ample means for the rapid handling of large cargoes. Comfortable accommodation is provided on bridge deck amidships for passengers, also for officers, engineers, etc., while the petty officers are berthed in forecastle, and the crew in poop. The machinery, which has been constructed by the builders, consists of quadruple-expansion engines having cylinders 25½ in., 36½ in., 52 in. and 74 in. dia. by 54 in. stroke, with steam from three boilers at 215 lbs. pressure.

Valenca.—On August 4th, there was launched at Ayr a steel twin-screw steamer, built to the order of Messrs. J. M. Campbell & Sons, Glasgow, for the Empreza Navagacao Bahiana, of Bahia. The vessel is intended for the ferry traffic at Bahia. Her dimensions are 116 ft. by 21 ft. by 7 ft. 6 in. depth moulded to main deck and 15 ft. to promenade deck. She is fitted for a large number of passengers, and for the carriage of a quantity of light cargo. Her machinery will consist of twin-screw triple-expansion engines, and it is anticipated a speed of about 11 knots will be attained.

Brentham.—On August 9th, there was launched at Govan the screw steamer *Brentham*, which has been built to the order of Messrs. Paton & Hendry, Glasgow. The vessel is of the following dimensions :—Length, 199 ft. 3 in. ; breadth, 30 ft. ; depth, 14 ft. 3 in. ; and of about 800 tons gross. The *Brentham*, which is designed for the coasting trade, is fitted with large hatches and self-trimming hold, designed for carrying heavy machinery and boilers.

Thomas Holt.—On August 9th, there was launched at Port Glasgow the finely-modelled steel screw passenger and cargo steamer *Thomas Holt*, which has been built to the order of Messrs. John Holt & Co., Ltd., Liverpool. The vessel is 260 ft. 6 in. long, and is intended for the West African trade. On the shelter deck accommodation is provided for the captain, officers, engineers and passengers, while the crew and Kroo boys have their quarters in the raised forecastle and poop. Special attention has been given to the ventilation of the vessel, electric fans being introduced. Mosquito screens have been fitted throughout. The steamer is equipped with refrigerating plant and cooling chamber. The new vessel has been built on the Isherwood system to Lloyd's highest class.

Chindwin.—On August 10th, there was launched at Dumbarton the steamer *Chindwin*, which has been built for Messrs. Henderson, of Glasgow. The *Chindwin* has been built to the highest class and under the special survey of the British Corporation. Her dimensions are :—Length between perpendiculars, 445 ft ; breadth moulded, 55 ft. ; depth moulded, 31 ft. 4 in. She is the largest vessel the Company has owned, the larger dimensions being necessitated by increased trade being done with Rangoon. There is accommodation for 100 passengers in roomy, well-lit state-rooms, also an installation of electric fans to neutralize the discomforts of the passage through the Red Sea. The propelling machinery will be supplied at Dumbarton.

Luciston.—On August 10th, there was launched at Port Glasgow a single-deck steel screw steamer, built to the order of Messrs. W. S. Miller & Co., Glasgow. The vessel, which has been built to Lloyd's highest class, is of the following dimensions :—Length, 323 ft. ; breadth, 48 ft. ; and depth, 24 ft. For the rapid handling of cargo the steamer is fully

equipped with derricks, self lubricating cargo blocks and gins, and has six winches and large donkey boiler. The holds are fitted with grain divisions in order that grain in bulk may be safely and conveniently carried.

Cannavieiras.—On August 12th, there was launched at Troon a twin-screw passenger steamer which has been built to the order of Messrs. John M. Campbell & Son, Glasgow, for Brazilian owners. The dimensions of the vessel are :—200 ft. by 32 ft. by 10 ft. 4 in. depth (moulded) to main deck, with continuous shelter deck. She is built to the highest class at Lloyd's for the South American coasting trade. Accommodation is provided for fifty-four first-class and twenty-four second-class passengers. She is to have a speed of 12½ knots. A Cochran (Annan) donkey boiler, with patent seamless furnace, has been supplied and fitted.

TRIAL TRIPS.

Baltistan.—On June 17th, the large steel screw steamer *Baltistan*, built by Messrs. W. Gray & Co., Ltd., for Messrs. Frank C. Strick & Co., Ltd., was taken on her trial trip. Mr. Archibald Walker, who has superintended the construction of the ship and machinery, represented the owners on the trial, Mr. James Innes, Lloyd's Registry, Captain J. E. Murrell, the shipbuilders, and Mr. Maurice S. Gibb the engine builders. The trial was a very satisfactory one, a speed of 13 knots being obtained. For launch, see May issue.

Ladywood.—On June 25th, Messrs. Osbourne, Graham and Co., Hylton, sent to sea for her official trial the steel screw steamer *Ladywood*. During the trial, which was in every way satisfactory, a speed of 11 knots was easily attained. See Launch in July issue.

Anna.—On June 27th, the s.s. *Anna*, of about 2200 tons deadweight, built by the Campbeltown Shipbuilding Co., Campbeltown, for German owners, ran trials at Wemyss Bay. The vessel is of the well-deck type with raised quarter deck, bridge and topgallant forecastle, and is specially arranged for the owners' timber and general trades. Messrs. J. G. Kincaid & Co., Ltd., Greenock, supplied the machinery, and on the trial a mean speed of 11½ knots was attained.

Zeelandia.—The twin-screw liner *Zeelandia*, the second vessel which Messrs. Alex. Stephen & Sons, Ltd., Linthouse, have built for the Koninklyke Hollandsche Lloyd, of Amsterdam, has just completed her speed trials on the Firth, and obtained a speed, loaded, of 16 knots—a remarkable result for a vessel with a deadweight capacity of over 7800 tons and dimensions of—Length, 460 ft ; breadth, 55 ft., and depth, 37 ft. After the trials the vessel left for Amsterdam, from which port she will sail for Buenos Ayres. For Launch see June issue.

Bideford.—On July 4th, the steel screw steamer *Bideford*, built by Messrs. Craig, Taylor & Co., Ltd., Stockton-on-Tees, for Messrs. W. J. Tatem & Co., of Cardiff, was taken to sea for her trial trip, which proved highly satisfactory. During the whole of the trip everything worked with the greatest smoothness, and over a series of runs a speed of 10½ knots was maintained, the vessel at the time being fully loaded. Immediately after the trial the vessel proceeded on her voyage to Alexandria under command of Captain Turner. For Launch see July issue.

Highland Corrie.—On July 5th, the new Nelson liner *Highland Corrie*, of 7400 tons, ran her speed trials on the Firth of Clyde, when excellent results were obtained. She was built at Port Glasgow for the meat-carrying trade between South America and Liverpool. For Launch see July issue.

St. Albans.—On July 6th, the new steamer *St. Albans*, built and engined by Messrs. Workman, Clark & Co., Belfast, for the Eastern and Australian Steamship Co., Ltd., London, left Belfast Harbour, and after adjustment of compasses and speed trials, which were highly satisfactory, the vessel proceeded to Cardiff to take in coal for Shanghai. For Launch see June issue.

Leucadia.—On July 7th, the s.s. *Leucadia*, built by the Tyne Iron Shipbuilding Co., Ltd., of Willington Quay-on-Tyne, for the International Line Steamship Co., Ltd., of Whitby, was taken to sea for her trial trip, and although the weather was stormy the vessel attained a mean speed of 10 knots. This trial is interesting, as the *Leucadia* is the first vessel to be built on the Tyne under the Isherwood system of longitudinal framing, a system which is having an increased vogue with both shipowners and shipbuilders.

Akassa.—On July 7th, the new steamer *Akassa* proceeded on her official trial trip after adjusting compasses in Hartlepool Bay. A large party attended the trial trip, which was in every way satisfactory, and although the weather was unfavourable a speed of about 13 knots was obtained. The owners were represented by Mr. Alex. Craigie, the shipbuilders by Mr. Robert Duncan, and the engineers by Mr. G. Urquhart. For Launch see June issue.

Corncrake.—On July 8th, the steamer *Corncrake*, built at Troon for the London and Antwerp service of the General Steam Navigation Co., underwent her trial trip with satisfactory results. On the mile a speed of 12½ knots was attained being considerably in excess of contract. For Launch see July issue.

Sergipe.—On July 8th, the official full speed trial of the torpedo-boat destroyer *Sergipe*, built for the Brazilian Government by Messrs. Yarrow & Co., Ltd., of Glasgow, took place on the Skelmorlie deep water measured mile at the mouth of the Clyde. The contract speed of 27 knots, carrying a load of 100 tons, was easily exceeded. The actual speed obtained was 27·676 knots on the mile, and 27·605 knots during a continuous run of three hours' duration. The *Sergipe* is the last of the ten destroyers ordered by the Brazilian Government from Messrs. Yarrow. The dimensions of these destroyers are :—Length, 240 ft. ; beam, 23 ft. 6 in. They are propelled by two sets of four-cylinder balanced reciprocating engines of 8000 horse-power collectively. Steam is supplied by two double-ended Yarrow boilers of the latest type. For Launch see June issue.

Jonathan Holt.—The new steamer *Jonathan Holt*, which has been built on the Clyde for Messrs. John Holt & Co., of Liverpool, has undergone her trials. Having accomplished good speed results, she left for Liverpool to load there on her maiden voyage. For Launch see July issue.

Duchess of Richmond.—On July 12th, the handsomely-modelled paddle steamer *Duchess of Richmond*, which Messrs. David & William Henderson & Co., Ltd., Meadowside Works, Partick, have built to the order of the London & South-Western and London, Brighton & South Coast Railway Co., for their Portsmouth and Isle of Wight traffic ran her trials on the Firth of Clyde. During the day, the machinery worked smoothly and a speed considerably in excess of the contract was attained. For Launch see July issue.

Stephen Furness.—On July 12th, the new steel screw passenger steamer *Stephen Furness* proceeded on her official trial trip in Hartlepool Bay after adjusting compasses, having previously loaded at Middlesbrough. The trial trip was exceedingly satisfactory, a mean speed of 15¾ knots being obtained on the measured mile. For Launch see July issue.

Teeswood.—On July 12th, the s.s. *Teeswood*, built by Messrs. W. Harkess & Son, Ltd., to the order of Messrs. the Meteor Steamship Co., Ltd., of Middlesbrough, was taken for her official trial trip, when a mean speed of 11 knots was obtained on a series of runs over the measured mile. Everything worked to the entire satisfaction of the owners, who were represented on the trial by Mr. Wm. Constantine. This steamer has been completed and delivered to her owners in less than three months from signing contract, and is the fourth steamer built by Messrs. W. Harkess & Son, Ltd., for the Meteor Steamship Co., Ltd.

Registan.—On July 14th, the large steel screw steamer *Registan*, built by Messrs. Wm. Gray & Co., Ltd., for Messrs. Frank C. Strick & Co., Ltd., of London, had her trial trip. The performance of ship and machinery was very satisfactory, a speed of 13·1 knots being obtained. For Launch see June issue.

Eggesford.—On July 16th, the steel screw steamer *Eggesford*, built by Messrs. Craig, Taylor & Co., Ltd., Stockton-on-Tees, for Messrs. W. J. Tatem & Co., of Cardiff, was taken to sea for her trial trip, which proved highly satisfactory. During the whole of the trip everything worked with the greatest smoothness, and over a series of runs a speed of 10½ knots was maintained, the vessel at the time being fully loaded. Immediately after the trial the vessel proceeded on her voyage to Leghorn under command of Captain King. For Launch see July issue.

Camerata. On June 25th the handsome steel screw steamer *Camerata*, built by Messrs. Wm. Gray & Co., Ltd., to the order of Messrs. Frank C. Strick & Co., Ltd., of London and Swansea, for La Tunisienne Steam Navigation Co., of Paris, had her trial trip. Mr. Archibald Walker, who has superintended the construction of ship and machinery, represented the owners on the trial; there were also on board Mr. James Innes and Mr. Ward, of Lloyd's Registry, Captain J. E. Murroll, representing the builders of the ship, and Mr. J. B. Williams, on behalf of the builders of the machinery. The trial was a very satisfactory one, the speed being 11½ knots. (See June issue for Launch.)

Boukadra.—On July 21st, the handsome steel screw steamer *Boukadra*, built by Messrs. Wm. Gray & Co., Ltd., to the order of Messrs. Frank C. Strick & Co., Ltd., of London and Swansea, for La Tunisienne Steam Navigation Co., of Paris, had her trial trip. The vessel has been built to Lloyd's highest class, and is of the following dimensions, *viz.*, length over all, 362 ft.; breadth, 50 ft.; and depth, 25 ft. 11½ in. She has long bridge and poop, and topgallant forecastle. The saloon, state-rooms, captain's and officers' rooms are fitted up in the poop, the engineers' accommodation in houses on the bridge deck, and the crew's berths in the forecastle. The hull is built with deep bulb angle frames, cellular double bottom and large aft-peak ballast tank. Ten steam winches, steam-steering gear amidships, hand-screw gear aft, patent direct steam windlass, large horizontal multitubular donkey boiler, stockless anchors, telescopic masts with fore and aft rig, boats on deck overhead, and all the requirements of a first-class cargo steamer, including Porter's patent derrick sockets for dealing with heavy lifts by combining the ship's ordinary derricks, have been fitted. Triple-expansion engines have been supplied by the Central Marine Engine Works of the builders, having cylinders 24 in., 38 in. and 64 in. diameter by 42 in. stroke, and two large steel boilers adapted for a pressure of 180 lbs. per square inch, worked under Howden's system of forced draught. The port openings in the cylinders are large, to ensure an easy passage for the steam, and so obtain the maximum efficiency from it. The engines are fitted with a "Contraflo" main condenser, a "Contraflo" atmospheric condenser being installed for the auxiliary machinery. A Morison surface feed-heater, combined with oil and air extractor, is also fitted, the engine-room auxiliaries, including a number of duplex pumps of the builders' "Cmew" type, being very complete and carried out in accordance with the requirements of the owners' superintendent engineer. The leading feature of the condenser design is a new method of temperature regulation, by means of which the air-withdrawing capacity of the air pump can be so adjusted to the demand that the thermal efficiency of the engines is at a maximum under all conditions of working, this arrangement having a favourable influence on economy.

Indian Prince.—On July 23rd, the new screw steamer *Indian Prince*, built by Messrs. John Readhead & Sons, Ltd., West Docks, South Shields, to the order of the Prince Line, Ltd., was taken to sea on her official trial trip. The vessel was run several times over the measured mile, the trial being in every way successful to both owners and builders. After the trial the vessel proceeded to Antwerp to take in cargo for the River Plate, under the command of Captain Kirkwood. (See July issue for Launch.)

Don Carlos.—On July 22nd, Messrs. Day, Summers & Co., Ltd., of Northam Iron Works, Southampton, carried out a successful trial of the new cargo and passenger steamer *Don Carlos*, which they have just completed for Messrs. Liebig's Extract of Meat Co., Ltd. The principal dimensions of the vessel are:—Length, B.P., 140 ft.; beam, 25 ft.; depth, 12 ft. 6 in.; tonnage, B.M., 415. This trial was carried out with the vessel in light trim, and she easily exceeded her contract speed of 11 knots on the measured mile for this condition. The machinery, which consists of one set of triple-expansion engines, having cylinders 14 in., 22 in. and 37 in. diameter by 27 in. stroke, working at a pressure of 160 lbs., indicated 730 horse-power. The vessel, which is built to Lloyd's highest class under special survey, has a hold capacity of 250 tons, bunker capacity of 50 tons, and accommodation on the main deck for twelve passengers, having a roomy dining-saloon, galley, bathrooms, etc. A teak deckhouse on the bridge deck includes accommodation for the captain, a wheelhouse with flying bridge over and companion.

San Remo.—On July 23rd, the new steel screw steamer *San Remo*, built by Messrs. Wood, Skinner & Co., Ltd., Bill Quay-on-Tyne, to the order of Mr. Otto Thoresen, of Christiania, Norway, for his special trades, left the Tyne for her official trial trip. During the trial run the machinery worked most satisfactorily, a mean speed of nearly 11 knots being easily maintained. (See July issue for Launch.)

Canadian Transport.—On July 26th, the fine steel screw cargo steamer, *Canadian Transport*, built by Messrs. Sir Raylton Dixon & Co., Ltd., of Cleveland Dockyard, Middlesbrough, to the order of the Empire Transport Co., Ltd., London, proceeded to sea for her official trials. The steamer has four holds, five hatches, two masts, nine derricks, and is equipped with seven powerful steam winches, steam windlass and hand and steam-steering gear and all the latest and most modern appliances for the rapid handling of cargo. Triple-expansion engines, having cylinders 25 in., 40 in. and 67 in. by 45 in. stroke, supplied with steam by three large single-ended boilers working at 180 lbs. pressure, have been fitted by Messrs. Richardsons, Westgarth & Co., Ltd., Middlesbrough. (See August issue for Launch.)

Bogstad.—On July 29th, Messrs. Osbourne, Graham & Co. sent to sea for her official trial trip the steel screw steamer *Bogstad*, which is the third vessel they have specially constructed to the order of Messrs. Fearnley & Eger, of Christiania. During the loaded trial, which was very satisfactory in every way, a speed considerably over the contract requirements, was easily attained. After the trial the vessel proceeded to Cronstadt, under the command of Captain Evensen. (See August issue for Launch.) A Cochran (Annan) donkey boiler, with patent seamless furnace, has been supplied and fitted.

Thistleban.—On July 30th, the steel screw steamer *Thistleban*, built by Messrs. Craig, Taylor & Co., Ltd., Stockton-on-Tees, to the order of Messrs. The Albyn Line, Ltd. (Messrs. Allan, Black & Co., Sunderland, Managers), was taken to sea for her trial trip, which proved highly satisfactory. The vessel is of the following dimensions, *viz.*:—382 ft. by 51 ft. 4½ in. by 26 ft. 6 in. moulded. She is built of steel to the highest class in Lloyd's Registry under special survey, and has poop, long bridge and forecastle combined, water ballast in double bottom fore and aft, and in peaks. She is fitted with patent direct steam windlass with quick-warping ends, steam-steering gear, eight steam winches, and multitubular donkey boiler, shifting boards in holds for carrying grain cargoes, telescopic masts to Manchester Ship Canal requirements, double derricks, and all the latest improvements for rapid loading and discharging. Her engines have been constructed by Messrs. Blair & Co., Ltd., Stockton-on-Tees, the cylinders being 26 in., 42½ in., 69½ in. by 45 in., with two large steel boilers working at 180 lbs. pressure. During the whole of the trip everything worked with the greatest smoothness, and over a series of runs a mean speed of slightly over 12 knots was maintained. Immediately after the trial the vessel proceeded under command of Captain Staveley.

Izabran.—On August 4th, this vessel, recently built by Messrs. Wm. Doxford & Sons, Ltd., Sunderland, for Messrs. Lucovich, Banaz & Harris, Ltd., of London, ran her full loaded trial from the Tyne, when a speed of 10·58 knots was registered on the measured mile. She carries 6,900 tons, and is fitted with tri-compound engines of 1,700 I.H.P., and has been built under the British Corporation Survey and Classification, and also receives the classification of the Austrian Veritas for their Registry.

Ariosto.—On August 6th, the fine steel screw steamer *Ariosto*, built by Messrs. The Northumberland Shipbuilding Company, Ltd., Howdon-on-Tyne, to the order of Messrs. Thos. Wilson, Sons & Co., Ltd., Hull, for their Eastern trade, left the Tyne for her trial trip. The steamer is 390 ft. long by 49 ft. beam by 29 ft. deep, and has been built under special survey to the highest class at Lloyd's, with two complete steel decks. She is fitted with long poop, long bridge, topgallant forecastle, the accommodation, which is very ample, being placed in steel houses on the bridge deck. The 'tween decks are lofty and so arranged that cattle, troops or emigrants may be carried if necessary. Very

special attention has been paid to the loading and discharging gear, and a complete outfit for the rapid handling of cargoes arranged for, consisting of eight steam winches by Messrs. Clarke, Chapman & Co., Ltd., Gateshead-on-Tyne, a large number of cargo derricks, steam windlass by Messrs. Clarke, Chapman & Co., Ltd., and powerful steam-steering gear by Messrs. Donkin. She is fitted, of course, with the usual water ballast arrangements for light passages. She has been constructed to a fine model with a view to rapid speed and economy in fuel, and the machinery has been supplied by Messrs. Richardsons, Westgarth & Co., Ltd., Sunderland, consisting of engines with cylinders 25 in., 41 in. and 60 in. by 48 in. stroke, three large steel boilers 180 lbs. pressure. The vessel is designed to carry about 7,500 tons deadweight on the light draught of 23 ft. 8 in. The trial trip proved in every way satisfactory, and after the trial trip, the vessel proceeded to Middlesbrough to load for the East, under the command of Captain Jones.

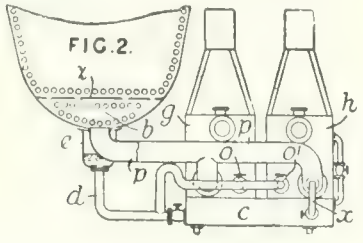
Kansas.—On August 11th, the new Bucknall Line steamer *Kansas*, built by Messrs. Workman, Clark & Co., Ltd., Belfast, left Belfast Harbour and proceeded to the Carrick Roads for adjustment of compasses, after which she proceeded on her speed trials over the measured mile course. The results attained were highly satisfactory to all concerned, and the vessel afterwards left for Barry to take in coal. (See August issue for Launch.)

Joseph Chamberlain.—On August 13th, the handsome steel screw steamer *Joseph Chamberlain*, built by Messrs. Wm. Gray & Co., Ltd., for Messrs. J. & R. O. Sanderson, of West Hartlepool and Cardiff, was taken for her trial trip. The trial was a highly satisfactory one, a mean speed of 11½ knots being registered. (See August issue for Launch).

The Marine Engineer and Naval Architect Patent Record.

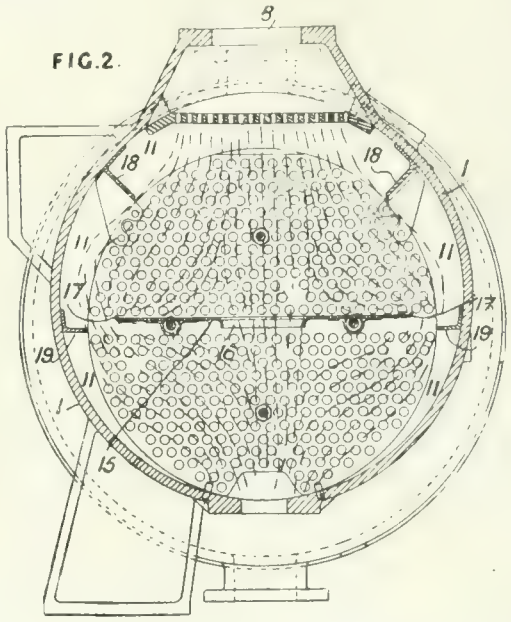
Compiled by Messrs. E. P. Alexander & Son, Chartered Patent Agents, 306, High Holborn, London, W.C.

No. 5809. Condenser Systems.—Two air-pumps (*g*, *h*) each capable of use as a wet air-pump, are arranged so that, under normal conditions, one pump (*h*) withdraws air and vapour only, being provided for this purpose with an injection of cooled water of condensation, while the other pump (*h*) withdraws water of condensation only, but, in the event of a breakdown of either pump, the other can be made to act as a wet air-pump without modification of the conditions prevailing in the condenser. When abnormal conditions prevail in the condenser, the two pumps may also both be worked in parallel as wet air-pumps. The injection water may be taken from the discharge of the air-pump



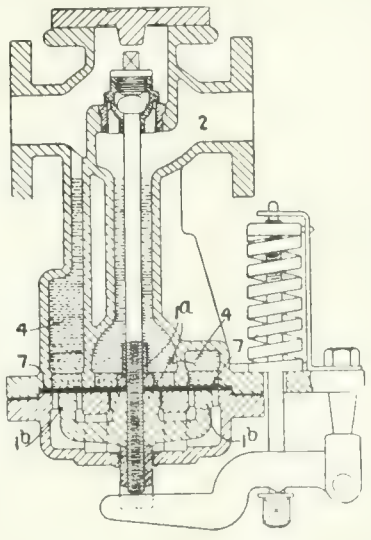
or may be derived directly from the condenser. It is cooled in a cooler (*c*) either in the base of the condenser or elsewhere, and may be led to the pump either through the pipe conveying the air and vapours or through a separate pipe (*x*) Both pumps may be connected by suitably valved pipes to the injection supply, and in the case where both pumps are used simultaneously as wet air-pumps, the whole of the water of condensation is cooled and divided between the pumps. The means for cooling and controlling the injection water, described in Specifications No. 21,120, A.D. 1906, and No. 17,303, A.D. 1907, may be employed. The water of condensation of the air and vapours may be led from the condenser to the pumps and by the same pipe or by separate pipes, as shown in Fig. 2, in which the air pipe (*p*) communicates with an air space (*b*) in the condenser, which is shielded by draining-plates (*z*), while the water pipe (*d*) communicates with a receiver (*e*). Valves (*o*, *o*¹) control the water supply to the pumps.

No. 6716. Condensers.—In a surface condenser, the tubes are arranged in a circular stack placed eccentrically with regard to the shell (1), so as to leave a steam space (11) at the top and sides of the stack. Baffle-plates (18, 19) are disposed in the space (11), so as to cause steam entering by the inlet



(8) to pass through the stack. Across the stack is placed a baffle-plate (15), with a central draining-opening (16) and turned-up edges (17). The end chambers are arranged concentrically with the tube stack and the tube-plates are just large enough to hold the stack.

No. 7271. Reducing Valves.—In a reducing-valve having a balancing diaphragm or piston to balance the inlet pressure on the valve, and an operating diaphragm or piston exposed to the reduced pressure, the pistons (1*a*, 1*b*) are made integral,



the latter being an annular extension of the former, and are arranged both on one side of a single diaphragm (7), which forms a tight joint between the initial and reduced pressure chambers (2, 4) respectively.

The Marine Engineer

And Naval Architect.

LONDON, OCTOBER, 1910.

STEAM WHISTLES FOR SIGNALLING.

WE have on many occasions recently referred to the necessity of having whistling devices made as certain and efficient as possible if the provisions as to signalling from vessel to vessel or from vessel to shore by whistle are to be really a means of safety, as if this is not done any defect in the operation is likely to cause the very reverse effect. We are glad to note that the Board of Trade have recently issued new regulations as to the construction and arrangement of whistle pipes owing to the attention of the Board being directed to the inefficiency of steam whistles on many vessels when suddenly called upon to produce a clear blast of a definite character. It is satisfactory to learn that the officials of the Board have at last awakened to the serious conditions that obtain at the present time, and which, for years past, have been patent to anyone who has sufficient intelligence to appreciate the importance of the matter. The Board registers its opinion that the inefficiency arises mainly from the collection of water as resulting from condensed steam, which has first to be blown out of the whistle pipe before a clear note can be sounded, and in such cases an attempt to make sound signals as prescribed in the regulations for preventing collisions at sea, especially those in Article 28, may be misleading and a serious source of danger to navigation. In the suggestions to surveyors the following are embodied for their guidance:—Whistle pipes should be carried from such a position as will ensure a full supply of dry steam being obtained while the vessel is under way, and if possible, bends should be avoided and a continuous inclination be given from the boiler to whistle, so that in ordinary conditions of trim and heel any water will drain back to the boiler. If these cannot be done, then reliable automatic drains should be provided which are to be always kept open. The diameter of pipes for all vessels except launches and small vessels should be at least 1½ inches internally and in the case of large vessels where the whistle is at a considerable distance from the boiler the area of the pipe is to be increased. It is further suggested that the pipes should be carefully and efficiently lagged and that such lagging should extend up to the whistle, unless an area considerably in excess of that suggested is used for the pipes. Any portion of the whistle pipe beneath the deck should not be less in diameter than that above it, and the area of all openings to the boiler should at least equal the area of the whistle pipe. Any means for shutting off the whistle pipes from the source of steam supply should be kept fully open when the steam is turned on, otherwise if only partially open any water present will not readily drain back through and thus be a source of inefficiency and consequent danger. The surveyors are to make actual trials of the whistle of all new vessels to ascertain if it is possible for them to be rendered partially inoperative through the collection of water, and unless a clear sounding blast is produced under all conditions the trial is not to be regarded as satisfactory. In regard to existing British vessels in which the steam whistle is reported or found to be inefficient, the attention of the owner or master is to be directed to the fact, and the nature of the defect causing the inefficiency is to be at the same time pointed out. In drawing up these regulations it does not seem to us that the Board have paid due attention to various devices at present on the market for overcoming the disadvantages which obtain with ordinary systems, but we hope that as time goes on the merits of such arrangements will have due weight given to them, and the regulations be clearly framed so as to include them as practical solutions of the problem.

LARGE LINERS AND HARBOUR DUES.

SOME time ago we made reference to the possible alteration of the basis of payment of harbour dues in the case of large vessels drawing more than the usual maximum draught, and we note that the Southampton Harbour Board, at their meeting last month, decided to seek Parliamentary powers to charge vessels on registered tonnage and on draught of water, instead of on registered tonnage only. They do not seek to make any extra charge on vessels drawing 30 feet of water or less, but on all vessels drawing over 30 feet they desire to charge, in addition to the authorised rates, ½d. per nett registered ton for every foot or fraction thereof over the 30 feet or fraction thereof. They further desire to charge vessels drawing 30 feet and under, calling in the river only, ½d. per nett registered ton, as at present, and those drawing more than 30 feet, ½d. per nett registered ton extra for each foot, or fraction of a foot, above the 30 feet draught, and at the same time to maintain the right to increase the charge up to the maximum defined in the schedule to the Act of 1887. In the discussion that took place when the Board dealt with the matter as presented to them in a report prepared by a special committee, the adoption of the course taken was opposed by some of the members, but the resolution was carried, with a certain number voting against it. In the course of such discussion it was elicited from the chairman by Mr. Curry, the local manager of the White Star Line, that a vessel drawing 34 feet 1 inch would have to pay 3½d. per ton, as

against 1d. now charged. The Board are already carrying out dredging operations to deepen the channel from 32 to 35 feet, to make the port easy of access at all states of the tide for ships of the dimensions of the White Star liners *Olympic* and *Titanic* and they asked both the White Star Company and the South-Western Railway Company to contribute towards the cost. As one would have expected, they received a refusal in both cases; in the first, the Shipping Company considered that they were doing their share in bringing traffic to Southampton, and the bigger the ships they ran, the greater the amount of dues they would pay the Board; in the second case, the Railway Company agreed to share the cost of dredging a particular shoal lying just outside the jurisdiction of the Harbour Board, but as to further assistance, they considered that as they were providing a new dock for the big liners, they ought not to be asked to do the work of the Harbour Board as well. It may be stated that the Board have now the power to increase the dues from 1d. to 2d. per ton, but they do not desire to penalize old Companies like the Union and Castle and the Royal Mail. However, the policy adopted by the Board in this matter does not appeal to us as representative of that broad-mindedness which should be characteristic of administration of such a body as the Harbour Board, it seems to us to be only dealing with two ships at the moment, and not as a body looking into the future for the development of the port. If the port is to be made attractive, then money must be spent for the purpose, and all users should share the burden on an equitable basis. Assume, for a moment, what would happen if the Board widened the channel, obtained power to increase their rate, and then the two or more steamers were offered equal facilities at lower rates at another port; it is obvious that the remainder of their customers would have to pay a larger price to make up for the loss of dues from the large ships. We have no doubt that the Parliamentary Committee will go fully into the merits of the case before passing the proposal, as the welfare of Southampton as a port is more or less involved in the scheme.

THE SHIPYARD STRIKES AND LOCK-OUT.

SINCE our last issue the industrial community in the North has been thrown into a state of disorganization by the action of the members of the Boilermakers' Society, owing to the inability of the executive to deal with their own members with regard to breaches of the terms of the national working agreement, which was arrived at between the Federation of Shipbuilding Employers and the Unions some two years ago. Sectional strikes have repeatedly taken place without regard to the terms of the agreement, and the employers have had no option but to post the notices. The ballot of the men would not give their executive authority to give satisfactory assurance as to the keeping of the agreement in the future, and a conference has been proceeding at Edinburgh between the two parties on the matters at issue, but at the moment things are at a standstill, as the men's representatives have returned home. From what has transpired up to the present there does not seem much hope of an early settlement unless the men adopt a more reasonable and business-like attitude with regard to their side of the question. Many of the propositions put forward by them must have been recognised by them as absolutely inacceptable by the masters, but we hope that by patience and common-sense on the one hand and more reasonableness on the other, an early solution to these trade-paralysing conditions will be found.

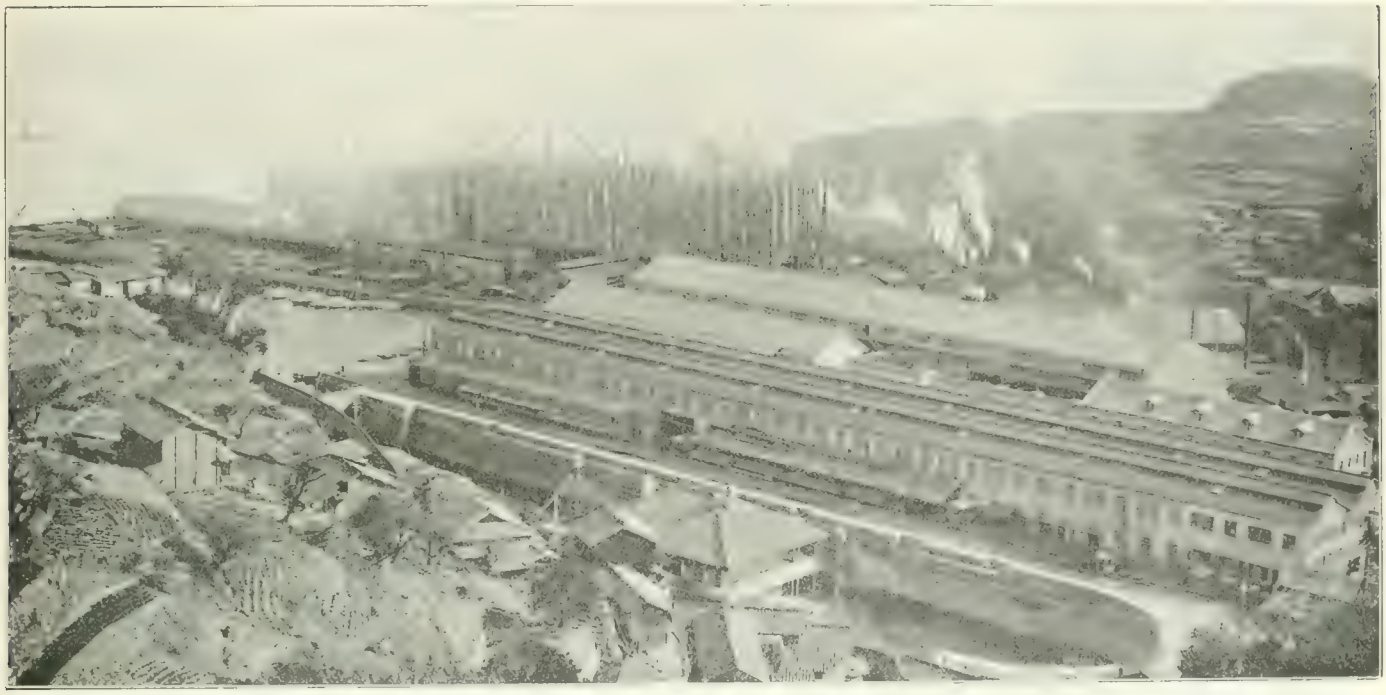
THE INTERNAL COMBUSTION ENGINE. By Mr. WM. P. DURTNALL. Referring to Part I. of this paper, contributed by Mr. Durtnall at the meeting of the Institute of Marine Engineers held at the Naval, Mercantile Marine and Engineering Exhibition at Olympia on September 17th, and which the reader will find printed *in extenso* in this number, Mr. Durtnall informs us that Part II. will deal with the application of internal combustion engines of large power, and show the great importance of valve setting, timing and ignition. Some particulars will also be given of the internal combustion turbine.

THE MITSU-BISHI DOCKYARD AND ENGINE WORKS.

(*Continued from page 37.*)

IN the shipyard at Nagasaki the experimental tank and apparatus for resolving diagrams and data, with a view to comparative analysis and improvements in model and design for different requirements of speed and carrying capacity, are completely equipped and quite in keeping with the other departments of the works. The waterway is 430 ft. long, 20 ft. broad, and 12 ft. 6 in. deep at one end to 12 ft. at the other, the six inches being allowed for drainage when emptying. Compartments are constructed at one end to serve as wet and dry docks for the models, also for spare gear, ballast weights, etc. At 25 ft. from one end the water-way begins to shallow on a slope at the sides, to allow the waves from the models to expend themselves, the racing track in the centre being left, however, the full depth up to the end. The modelling machine, tank, carriage and accessories for the tank were supplied by Messrs. Kelso & Co., Glasgow. The offices in connection with the experimental work are well arranged and suited for the accommodation of the staff employed under the supervision of the chief ship draughtsman.

Like the large modern self-contained works, there is a testing house and a laboratory fitted and equipped for dealing with the testing of material and working gear, and the analyses of compositions and combinations. The lighting and power distribution systems are electric for the most part. The central station contains two Turbo alternators, direct coupled to Parsons turbines, each of 500 k.w.; one direct-current generator, coupled to a Willans engine, also of 500 k.w.; two direct-current dynamos, coupled to Willans engines, each of 100 k.w.; two direct-current dynamos, coupled to McIntosh, Seymour & Co.'s vertical compound engines, each of 225 k.w.; and a 300 k.w. direct-current dynamo, coupled to a three-phase induction motor; also, two dynamos, each of 25 k.w., coupled to one three-phase induction motor and a motor generator of 100 k.w. for



The Mitsu Bishi Dockyard and Engine Works.
Tategami Shipyard and No. 1 Dock.

Akimoura Engine Works and No. 2 Dock with 150-ton Giant Crane, 1910.

charging secondary batteries of 3000 amp. hours capacity. For the heavy shipyard machines there is an installation of hydraulic power of 1500 lbs. pressure, and for some of the engine and boiler shops a similar system is installed of 1200 lbs. pressure. In addition to the electrical and hydraulic systems, there is a pneumatic plant, with two compressors, each capable of delivering 215 cubic feet of air per minute, with a terminal pressure of 100 lbs. for riveting, drilling, caulking, chipping, etc.

The interests of the men employed in the works are not simply confined to the hard and fast lines of business, but their welfare, apart from the shop, has received consideration in the establishment of a pension scheme and a savings bank, and also a workmen's protection scheme, which has been in satisfactory service since 1897. There are three sections in the scheme: I., Injury; II., Pension; III., Sickness, marriage, birth and death. Under No. 1, the compensation varies according to the nature of the injury and class of workman from £5 to £300; under No. 2, the workmen each contribute a proportion regularly, the Company contributing a similar amount; the pension is graduated according to the class of workmen and time of service, those of ten years' service being granted from £9 to £70, and those of twenty-five years' service from £40 to £300. Under No. 3, each employee deposits a proportion of his wages, the Company contributes a similar amount. The benefit varies from 2½d. to 2/- per day for four months during sickness; 14/- to £5 for marriage expenses; 4/- to £5 for a birth or a death of near relative; and 10/- for conscription.

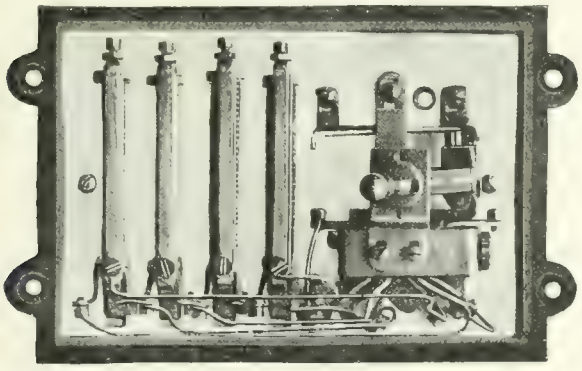
Besides the shipyard and engine works at Nagasaki, the Company in 1905 inaugurated works at Kobe. A floating dock of 7000 tons lifting capacity was built at the Nagasaki establishment and towed to Kobe. Two years later another floating dock of 12,000 tons lifting capacity was under course of construction, and the building of workshops on a large scale was commenced. The No. 2 floating dock was launched towards the close of 1908, and in December it was occupied by the *Mishima Maru*, of 8,600 tons gross. The works at Kobe are now in a position to build vessels of 10,000 tons. The area embraced by this establishment is 82 acres, with a sea frontage of 5000 ft., on which are building berths to take seven vessels at once of over 500 ft. long. There is also a water basin of 14 acres, protected by a breakwater 1000 ft. long, with a good sea entrance alongside the basin, where vessels can lie under protection at moorings for repair, overhaul or refitting. There is a steel tripod sheer-legs, designed and constructed by Messrs. Day, Summers & Co., Southampton. There are mooring buoys, means of communication and transport which are arranged to facilitate work. There are floating sheer-legs of 40 tons working load, built at Nagasaki, and a salvage steamer *Arima Maru*, with pumps of 2000 tons capacity per hour. The "Workmen's Friendly Scheme" in operation at Kobe is similar to that referred to at Nagasaki.

The Mitsu Bishi Dockyard and Engine Works, No. 3 Dock and S.S. "Minnesota."

THE WATKIN ELECTRIC SWITCH.

HOW often have those users of electric current for lighting purposes wished for some means by which the same economic advantages in manipulation and regulation of the supply of electricity could be obtained, as in the case of the use of gas. There is no doubt that the use of an electric lamp from the conditions of darkness to maximum light with no possible intermediate variation is a distinct limitation to the use of electricity when due regard to economy has to be maintained.

A device which enables the quantity of current delivered to an incandescent lamp to be regulated so as to vary the amount of illumination, and at the same time save the cost of current, must supply a want which has been felt for some years. The conditions under which a small amount of light is necessary during a considerable period do not obtain to a greater extent than in a lighting installation on board ship, particularly relative to cabins which are placed in-board and can only obtain light by artificial means. Then again there are corridors, lavatories, and other similar places where during a considerable portion of the night a



glimmer of light is quite sufficient to render a reasonable use under general conditions. The regulation of the passage of current for controlling the power delivered, has, of course, been effected by means of a series of resistances which can be switched in and out of circuit as circumstances require, the heat generated in such resistances having to be dissipated by radiation to the atmosphere. However, these devices have usually involved considerable weight and space, but it does not appear to have occurred to people that there was a desire for a graduated current controller which is applicable for use with a single lamp.

The Adams Watkin Company, Limited, of Victoria Street, London, W., have placed on the market an extremely ingenious switch by which the variation in current supplied can be made in various steps. One form of the switch is illustrated in the accompanying diagram which represents a switch of square formation, but the makers manufacture their article in the form of the ordinary tumbler switch of a size which is only slightly larger than ordinary switches of standard make. There is nothing, of course, remarkable in the electrical arrangement of the switch at all, as will be seen from the illustration; this particular device consists of four resistance elements disposed parallel to one another, with the necessary connections to a series of contacts over which the movable contact of the switch can pass, so as to cut out all the resistances for full current or insert one or more according to the amount of current required for the purpose. You cannot, of course, insert the resistance to oppose part of the current unless some heat is generated, which has to be dissipated, and the main feature of the device is the peculiar formation and the character of the resistances employed. In a test which has been made by a recognised testing Institution it has been shown that with a switch having six regulating steps, the actual current saved varied as follows:—

No. 1	79·1 %
No. 2	68·6 %
No. 3	53·2 %
No. 4	40·5 %
No. 5	29·1 %
No. 6	12·3 %

It will, of course, be understood that the seventh step is the one when the whole of the current is passing through a lamp for example, and none passing through the resistances, so that you have seven different rates of consumption which can be regulated by the switch itself.

In the figures given the No. 1 step is that when the lamp glows to a very small extent so as to give a night-light effect, and under these conditions four-fifths of the current is saved compared with the current used when the lamp is taking the whole current, as is the case in ordinary conditions of use. A further important feature may also be mentioned with reference to the metallic filament lamps which have of recent years been so largely adopted owing to their much higher lighting efficiency per unit of current compared with the ordinary carbon filament lamps. Experience has shown, however, that the metallic filaments are much more fragile, and therefore more liable to fracture than carbon filaments, and that risk of fracture is materially increased by the sudden switching on of the current. The Watkin Switch deals with this point very effectively as the current is switched on gradually through various steps of resistances which are gradually cut out in the usual way until the maximum current flows. It will be understood of course that with a switch of this character there is no necessity for re-wiring at all, the only thing to do is to substitute a Watkin Switch for the ordinary switch on the existing wiring. Although we have been dealing with the switch for the purpose of lighting it is quite obvious that it can be used for any other purpose for which a variable supply of electrical current is used, either heating or power purposes.

Engineering and Machinery Exhibition, Manchester. This Exhibition promises to be a great success. Many novelties in design and improvements in existing designs will be shown for the first time, and the fact that no engineering exhibition has been held in Manchester for twenty-two years should ensure a record attendance. The opening ceremony will take place on October 14th, presided over by the Right Hon. Sir George Reid, P.C., etc. The *Engineering Review* announce that they will organize a great International Exhibition in London, and that Olympia has been taken for the purpose. The Exhibition will be held in 1912, from October 4th to 24th, inclusive.

Messrs. Cochran & Co., Annan, Ltd., have fitted their donkey boilers, with patent seamless furnace, to the following vessels:—s.s. *Driebergen*, s.s. *Thisbe*, s.s. *Broompark* and s.s. *Cannavieras*.

NAUTICAL INSTRUMENTS.

THE great advance in the construction of nautical instruments during the past few years is well exemplified in the complete set of devices exhibited by the well-known firm of Messrs. Henry Hughes & Son, Ltd., of Fenchurch Street, London, at the Engineering and Machinery Exhibition at Olympia during last month. Advance in this direction is due to the increase in size and speed of vessels, with the view of obtaining increased accuracy and certainty of action necessary owing thereto.

Among the exhibits may be mentioned a new standard compass having a special spring suspension, an attachment for taking bearings without removing the binnacle top, the special adjustment of magnets lately adopted by the British Admiralty, and a new azimuth sight with two prisms and lens to give accurate reading and a correcting lens for different altitudes of sun and stars. The sounding machines shown are fitted with a new depth gauge which, on careful testing at Kew, is shown to give more accurate readings than glass tubes. Chronometers with Class A Kew certificates, giving temperature rates, are also exhibited, a class of instrument which should be carried by every ship.

Among the sextant class are included those for stellar observations with chronograph attached, double sextants and station pointers for marine survey and chart work. An interesting exhibit is a Nicholson log for recording the speed of a ship on a drum by means of pressure set up in two tubes by floats located down the centre of the ship, which on practical tests from a number of logs already fitted has shown very accurate results.

A number of aneroid barometers are included, among which are some specially designed for sea use in cyclone areas and used extensively in the Indian and Japanese waters, and should be on all vessels trading in the East. Semaphores of the light and heavy patterns as supplied to the British Navy and the principal steamship companies, binoculars and telescopes verified at Kew and clocks for both engine-room and saloon purposes find a place among the exhibits, and Morse signalling lamps, especially of the "Endall" pattern, of which the firm are makers, complete the interesting collection of nautical instruments.

It is important to bear in mind the fact that some years ago the firm established a testing department at their works, and we understand that every instrument made by any manufacturer and sold by them is tested by special apparatus and standardized by the observations of Greenwich and Bidston without the necessity of the instruments being sent to those places, but at the same time the recognised standard of the Observatory is obtained.

The visit of the German Association of Gas and Water Engineers to Great Britain, which was postponed on account of the death of King Edward, has now been arranged to take place during the week commencing 3rd October next. The visitors are to be the guests of the Institution of Gas Engineers, the Gas Light and Coke Company, the South Metropolitan Gas Company, the Croydon Gas Company, and the Corporations of Edinburgh and Glasgow respectively, of which latter city the engineer of the gas department, Mr. Alex. Wilson, M.Inst.C.E., is now the president of the Institution of Gas Engineers.

THE NAVAL, MERCANTILE MARINE AND ENGINEERING EXHIBITION, OLYMPIA.

Description of the Exhibits.

THE service rendered to the community by this exhibition may be appraised at a high value. The exhibits, on the whole, were worthy of the occasion and a goodly proportion of them were of sufficient general interest to attract and appeal to visitors whose engineering instincts may be considered more passive than active, including among these ladies, young Volunteer cadets and others comprehended under the expression, the general public—who seemed to take an intelligent interest in several of the stalls, and to such their visits must have been of considerable educational value. The encouragement given to the various engineering societies to visit the exhibition was a commendable feature in the plans of the promoters, and it was well responded to. The object in view of exhibitors is to show specimens of their work to probable or likely customers, and book orders. This object was recognised as important by the exhibition authorities and they were liberal in dealing with it. From the apparent results the exhibitors have been pleased to receive desirable visitors, and the latter have been gratified by the reception accorded to them. The catalogue of the exhibition is full of information, useful for reference, and among so many appliances it is difficult to apportion to each the attention which is due to its importance. On one of the best filled spaces was that allotted to Messrs. Henry Hughes and Son, Fenchurch Street, who exhibited instruments and other apparatus indispensable to the seaman. Messrs. James Walker & Co., of packing fame, made a good display of their specialities, their well-known Lion packing being a marked feature, which has met with high appreciation on the part of those using it. Messrs. Beardmore & Co., Ltd., showed to advantage the fine work for which they are noted, and special attention was directed to the marine type of gas engine which the firm has given special attention to developing for fishing craft and trawlers, with economical results.

Messrs. Hindley & Sons exhibited types of engines of their manufacture, both gas and steam. The former was represented by a three-cylinder engine of 75 B.H.P. for coupling direct to an electric set, and the latter by two small engines, neat and well finished, the one being an enclosed high-speed engine, the other an open engine. The small pamphlet issued by this firm is interesting reading; a comparison is instituted between the gas and the steam engine, with hints as to the best economy to be obtained. A water wheel built at their works in 1837 is stated to be, probably, the largest in England. At Messrs. J. Downton & Co.'s stall, one had a good opportunity of seeing specimens of their specialities, their pumps which have made the name of the firm a household or shiphold word, lavatory and cabin fittings. The neat lavatory and sanitary arrangements for yachts and small vessels or motor boats were specially worthy of notice, suited for fitting either above or below the water level. This firm's works are at West India Dock Road, and those who are in search of fittings and appliances in connection with the lavatory and sanitary arrangements or cabin fittings for small vessels are recommended to visit the works.

Messrs. Chadburn's (Ship) Telegraph Co. had a capital display of their manufactures, standards, dials, engine-room telegraphs and recording instruments, which drew an admiring crowd to examine and test. The name has been so long associated with such instruments that the quality and finish of the work need no confirmation. It is noted that telegraphs have been fitted by Messrs. Chadburn to over 1200 warships of various nationalities, and over 12,000 vessels in the mercantile marine, including the *Lusitania* and *Mauretania*.

Messrs. A. Blackmore & Co. exhibited and explained the action of the Bevan lock nut, which seemed good and efficient for the purpose intended. The nut locks automatically as it is screwed up, and cannot slacken back, yet can be readily unscrewed from the bolt when desired by means of an unlocking pin. The stall of Price's Patent Candle Co. formed a most interesting study from an engineering point of view; the great variety of oils suited for all conceivable purposes, light and heavy bearings, high-speed and low-speed journals, cylinders and valves, enclosed engines, machines and tools, were to be seen and the reasons for the adoption

of each class of oil explained. Motor and gas engine flash and lubricating oils, soaps specially manufactured for cleansing one's digits when soiled and greasy. The study of lubricating oils with the object of reducing friction to a minimum and the cost of the lubricant to the lowest limit has become a very important one, and its importance was quite apparently realized here. From the lubricant to the lubricator brings us to the exhibits of Messrs. R. Klinger & Co., whose automatic lubricator for locomotives and road vehicles has been altered and made suitable for marine engines. The packings and jointing material (Klingerit) manufactured by this firm were well displayed, also their improved gauge cocks, packed with a special quality of asbestos, not by the usual method, but by means of an inner liner in the body of the cock casing, readily removable for overhaul or renewal and being of standard size readily obtainable from the makers at a small cost.

The Combination Metallic Packing Co. showed samples of their patent metal combination packing for piston or valve rods, turbines and pumps, showing illustrations of its durability and small amount of wear. Metal jointing rings specially made to suit different conditions of work and service, automatic drain valves of an improved type suitable for all classes of steam pipes to prevent accumulation of water; lubricators for delivering set quantities of oil to cylinders, neatly designed and well made. The Worthington Pump Co. had a large stand fitted with a condensing plant in operation, and showing the high efficiency which may be attained by the set of pumps and condenser shown at work. Rotary or centrifugal pumps, steam and electrically driven, feed and general service pumps, direct plunger type and centrifugal. Air compressors, compact and occupying small floor space, and the "Arrow" water meter, which is stated to be reliable and accurate in action, suitable for pressures up to 750 lbs., and for diameter of pipes from 2 in. to 48 in., are also manufactured by this firm. Messrs. Allen & Simmonds showed specimens and models of Allen's patent specialities, the frictionless piston, in three segments backed by springs to give an even compression all round the circumference of the chamber; piston rod packings, furnace bars, Presto boat launching gear. The use of graphite has come into more general use owing to the care which is taken in the manufacture of it for engineering purposes, and the Graphite Products Co. showed samples of the various uses to which it is applied for mixing with oil for lubricating purposes; silica graphite paint for protecting exposed steel or iron structures, graphite greases for rope pulleys and other service; graphite pipe joint compound to use in place of red lead for joints; graphite of various grades for foundry work, for packings and other purposes. A heat-resisting paint which withstands 600° to 800° Fahr. The machines exhibited by Messrs. Cunliffe & Groom showed the high-class work which is produced for workshops to deal smartly and accurately with their every-day jobs. Milling machines of standard sizes, and the largest one with a capacity of 30 in. by 7½ in. by 20 in. was shown in action, driven by a motor. Drilling, shaping and planing machines and a small universal milling machine designed specially to serve as the handy machine for the workshop claimed much interested attention.

Messrs. Clarke, Chapman & Co. are so well-known and have so many appliances for deck machinery in general use that the firm was content to show photographs of most of their manufactures, winches, windlasses, capstans, either steam or electrically driven; dynamos and motors, hauling gears, searchlight projectors and accessories, direct-acting feed pumps, etc. Much interest was centred on the new water-tube boiler, a model of which was shown to illustrate the design of the tubes and drums, baffle plates and all the connections—which may be reproduced in a subsequent issue. The Hoyt Metal Co. exhibited a die-casting machine, self-contained and complete, suitable for small castings under compression; a very handy machine, convenient and compact. Specimens were exhibited and samples of Hoyt's standard antifriction metal. The stand occupied by Messrs. Henry Pels & Co. was well set out with the various machines made by this firm, driven by hand, motor or steam power, and as these were shown at work for punching and shearing, the visitor had every means of judging what could be done by the machines. The amount of power centred in the small space occupied was specially noticeable in the shearing of bars, round and square, and cutting of channel bars of large section.

The Dexine Company made excellent use of the space allotted to them by having a large display of samples, embracing pump buckets, by which friction is eliminated and efficiency brought to a high pitch. These buckets can stand a temperature of 350° with a working pressure of 500 lbs. High-pressure jointing material for superheaters, as used in British and Foreign navies, tough and heat resisting; gauge glass rings, of a nature which resists deterioration under heat and pressure, maintaining their flexibility under service; manhole door and other joints; valves of different shapes and types, all made of the Dexine, which gives the name to the firm and competes successfully with rubber in many of the services in the engine-room. When centrifugal pumps are discussed, the name of Gwynne naturally suggests itself. This firm showed to advantage an Invincible direct-acting centrifugal circulating pump, with a delivery of 3,000 gallons per minute through a 12-in. pipe; a pressure pump of the same name and lineage, capable of delivering 50 tons per hour from the bilges, against heads from 1 lb. up to 60 lbs., as supplied to the Admiralty; several other styles of pumps were on view to suit different requirements, steam, gas or electrically driven. A through-way valve for sea connection was worth noting, the object served being to have the bilge and sea openings so arranged that there is no risk of the sea being open to the bilge.

The Campbell Engineering Co. showed several exhibits of special interest, a small direct-acting boiler-feed pump, for either horizontal or vertical position, with valve directly controlled, simple and neat, with working parts reduced to the lowest number; a reducing valve, which, although it has been in land service for many years with good credentials, is new to marine practice, but promises not to remain so; an oil filter shown in action, and the results placed before the observer, seemed an admirable adjunct to the outfit of an engine-room; samples of high-grade belting, chrome tanned, specially suitable for running in very hot or damp atmospheres; a return steam trap and automatic damper regulator are also under the agency of this firm, as is also the Crosthwaite Furnace Bar set, which has done good duty on land to some extent with gratifying results, and is now introduced to marine work. The Medway Safety Lift Co. show one of their safety lifts in operation, and on the passage up and down it was demonstrated how reliable and safe the lift is; the motive power is electric, and in the event of either the cage door or the casing door being left unfastened, the cage remains still. For passenger steamers where there is need for such from the steward's store-rooms, an application of the Medway Lift would form a useful appendage. A pamphlet entitled "Electric Lift Control" has been published by this firm and may be had on application. It forms interesting reading and gives information of a valuable kind to those who deal with lifts or are likely to require them.

Messrs. Perkin & Co. had on view an excellent show of tools, including self-acting lathes, fitted with all the recent improvements for handiness and accuracy in working; English made; a wall drill, portable valve seat planing machine, slotting machine, shaping machine, disc grinder, drill grinders, hack sawing machines, patent portable rail-drilling machine, the whole making a good set to tempt customers.

The Crosby Steam Gauge & Valve Co. have a large number of specialities, and among those on view were a gauge-testing machine, which can test up to 25,000 lbs. per sq. inch; a feed water regulator, the automatic action of which operates as soon as the water-levels fall below a set standard, and puts the pump in motion; a steam whistle, fitted with a water arrester, to enable the whistle to be served with dry steam and prevent the pauses due to water accumulation (the automatic drain valve returns the water to the boiler); an electric timing device for steam whistles to comply with the regulations as to time blasts, especially in foggy weather; indicators and accessories; reducing valve and pressure regulators; pressure and vacuum recorders; lubricators, safety valves, etc. The Patent File and Tool Co. have come to the front of recent years with their special cutters, which take the place of the ordinary file and do the work more effectively, leaving a better finished surface. Their use is extending, and, as they can readily be recut, it would appear that to those who have not used

them, they are worth a trial. MESSRS. J. BARKER & CO. showed a capital bending machine—the Kennedy Patent. With it tubes may be bent without filling or loading to prevent collapse; angle-irons and sections can also be bent on the same machine and without heating. It is portable and a very handy and useful machine.

THE ECONOMIC FORCED DRAUGHT & ENGINEERING CO. show an arrangement of boiler front which is calculated to minimize the tear and wear on the baffle plates, which, in the ordinary style of front and door, burn away rapidly. In the style of front shown the air passages and the whole construction are designed to preserve the fronts and the baffle plates and reduce the tear and wear. The Economic Forced Draught & Engineering Co. exhibited an improved furnace front for natural draught and closed stokeholds. The object of the patentee is to avoid bolts and other appliances which require skilled labour to fit and refit and facilitate removal and replacement. MESSRS. LAMPLOUGH AND SON showed models of their valveless rotary pumps, strong and serviceable, quiet and positive in action; a rotary blower on the same principle; an exhauster and vacuum pump; an internal combustion engine of a type which is well worthy of study by marine engineers, who have been devoting a good deal of attention to the gas engine within recent years.

MESSRS. MATTHEW KEENAN & CO., whose non-conducting material is widely known, showed specimens of the work of their men in applying the non-conductor to pipes, etc., illustrating neatness of finish and deftness of hand. MESSRS. DAMPNEY'S compositions for preventing incrustation; for preserving iron and steel from deterioration; antifouling compositions; preparations for coating substances under various conditions which expose them to rapid waste, were exhibited and their nature and object explained.

MESSRS. CAMMELL, LAIRD & CO. had a fine display of models illustrative of the class of work with which their name is associated. Other firms were represented by specimens of their workmanship, the merits of which it is hard to pass over without special mention. MESSRS. BROWN BROS., whose name and fame have reached far and wide for their good work in hydraulic machinery, showed a telemotor for steering gear, the history of which with description and illustrations, was given in a well-considered paper read before the Members of the Institute of Marine Engineers on September 17th. The exhibits of MESSRS. WALLACH BROS. were of a comprehensive character, and aroused a large amount of interest. The "Pat" valve, of simple make and action, which has come largely into general service, was seen in use and in model; drilling machines, electrically driven; improved hand-lathe chuck; pulleys and shafting; draught indicators; gauge glass protectors; asbestos-packed cocks; tools; oil filters and tanks; rubber, asbestos and composite jointing materials; fireproof paints, etc.

The crowd of onlookers around the stalls where cutting and welding of iron and steel by the application of the oxy-acetylene blow-pipe took place, showed the great desire to know more about the process. THE BRITISH OXYGEN CO.'S operator gave demonstrations from time to time, and called special attention to the improved blow-pipe designed by the Company, and which has proved of infinite service. One advantage is that in confined spaces the orifice can be turned and adjusted to any desired position to reach the work in hand. THE ACETYLENE ILLUMINATING CO. also had on view their plant for cutting and welding, and gave demonstrations to the large number of visitors who crowded round to see the cutting of steel in a manner which excited wonder in those to whom the process was new.

THE OZONAIR CO., whose advocacy of pure air and good ventilation has brought their system into wide repute, showed the plant they manufacture for the purpose of sweetening the atmosphere of dwellings, shops and buildings, by means of ozone, applicable, indeed, to ships and spaces of all kinds. The exhibits of THE STERN SONNEBORN OIL CO. were well shown for the advantage of visitors to whom their specialities appealed; lubricators and lubricants, Sternoline bricks for tunnel bearings, economical and clean. MESSRS. DRUMMOND BROS'. stand contained lathes and drilling machines, suitable for engine-room use, and one small model lathe with motor, especially adapted for home service or school workshop.

ELECTRO-MAGNETIC TRANSMISSION FOR MARINE PROPULSION.*

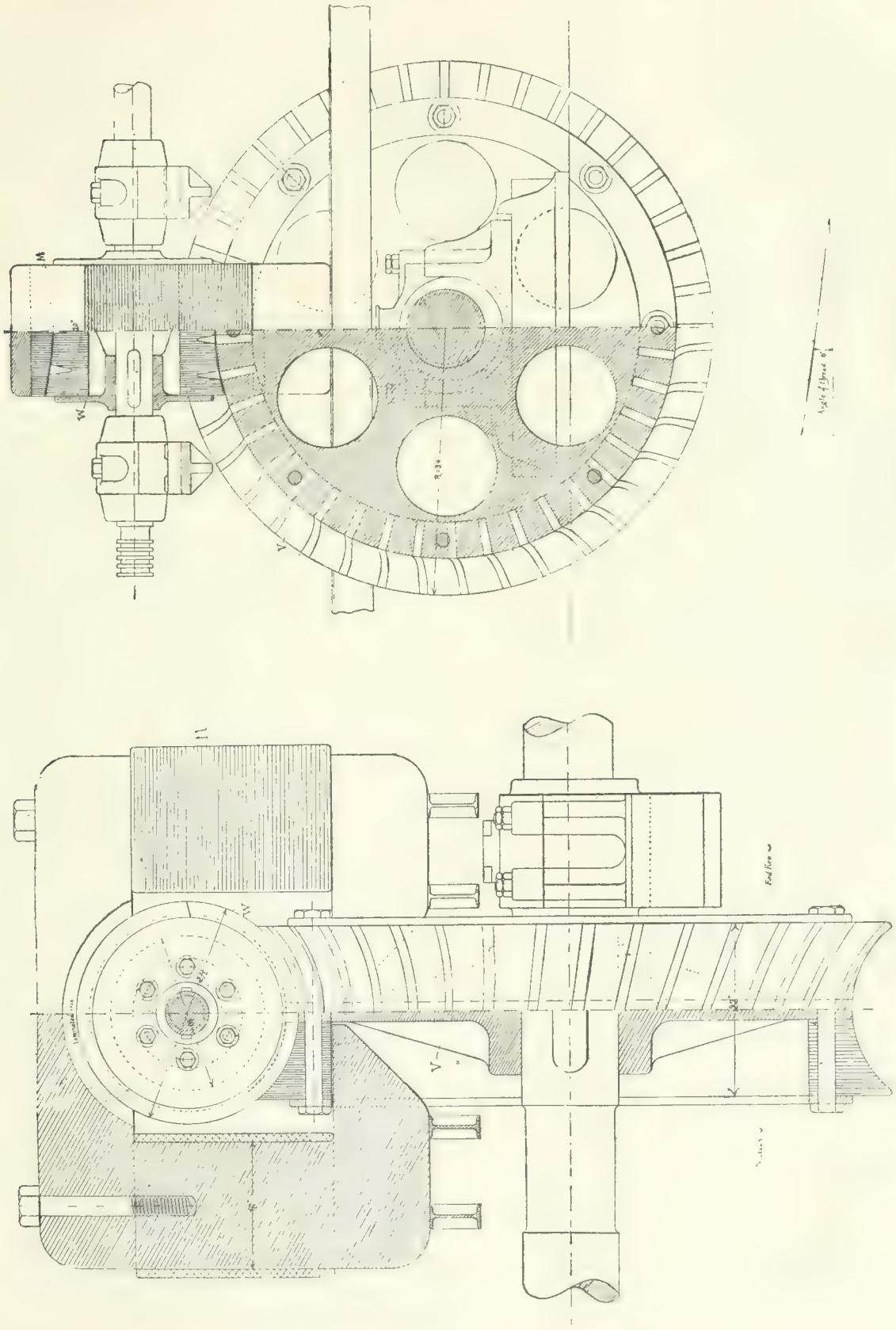
By Mr. JULES LECOCHE (Member).

IT is now generally admitted that the combination of a reciprocating engine with an exhaust steam turbine provides the most satisfactory solution of the problem of marine propulsion, whenever a high efficiency is of paramount importance. However, when he comes to put this principle into practice, the marine engineer is soon confronted with a number of difficulties which, while not actually insuperable, are only got over at the cost of both the efficiency and simplicity of the arrangement.

The use of two propellers driven by the reciprocating engine and by the turbine respectively need hardly be taken into consideration on account of the great difference between the speed and brake-horse-power of both machines. Under these conditions, the only solution lies in an arrangement whereby the power of the turbine is transmitted, at a suitably reduced speed, to the main, or reciprocating engine shaft, so as to assist the latter in the propulsion of the ship. A mechanical speed-reduction gear suggests itself as the simplest realization of this arrangement. However, it must be remembered that, under certain conditions of the sea, the reciprocating engine of a boat shows a marked tendency to race; a tendency which is by no means equally shared by the turbine. If, therefore, the connection between both machines is effected by means of the usual system of gearing, the teeth of the latter will in all probability be stripped off, as soon as from some reason or other, the resistance on the main shaft is appreciably reduced. If to this we add the noise, vibrations, wear and tear and the comparatively low efficiency of mechanical gearing for such high ratio as $\frac{3000}{75}$ revolutions per minute, it will be reasonably admitted that no mechanical gear can afford a satisfactory solution of the problem before us. Other means for transmitting power and simultaneously reducing the speed are the hydraulic and electrical transmissions, both of which have been tried in connection with marine propulsion. The former alternative, as conceived at present, can hardly be expected to meet the requirements of the marine engineer, on account of its comparatively low efficiency, excessive wear, weight and cost. The second alternative, namely, the electrical transmission, appears very attractive from the point of view of flexibility and ease of control. However important these factors undoubtedly are, other conditions must be complied with before an electric transmission can be conveniently adopted for the purpose in question. The first of these conditions is a high efficiency. In speaking of this system as a "transmission," one is apt to forget that the actual transmission is only part of the process, the latter being essentially a "transformation" of mechanical power into electrical energy, and again of electrical energy into mechanical power. Taking into consideration the individual efficiency of each single element (generator and motor) of this transmission, it will be found that the combined efficiency cannot be very high, especially when the motor is designed to run at such low speed as seventy-five revolutions per minute. Other serious drawbacks of this system are the weight and cost of the slow-running electric motor and also the necessity of resorting to high tension voltage, the presence of which is more or less unwelcome aboard ships.

The application of the "Magnetic gear" to marine exhaust-steam turbines was suggested on account of its high efficiency, noiselessness, positive drive, cheapness of upkeep (there being no wear and no need for lubrication, except in the bearings) and, last but not least, on account of this valuable peculiarity that, as soon as the reciprocating engine begins to race, the transmission comes automatically out of gear, thus effectively protecting the machinery against injury. Compared with both dynamo and motor, the magnetic gear has the advantage that it requires only a nominal amount of electrical energy. In fact, the latter is only an accessory, and the current being of comparatively low voltage can usually be supplied by the existing lighting sets. Although the simplicity of construction and action of the magnetic gear is almost

*Read at the meeting of the Institute of Marine Engineers held at the Naval Mercantile Marine and Engineering Exhibition, Olympia, on Saturday, Sept. 17th. Chairman, Sir David Gill, K.C.B.



Electro Magnetic Transmission for Marine Propulsion. 800 H.P. Magnetic Gear, Speeds 300 to 75

suggested by the name itself, I think a brief description of the machine may be found of interest.

The illustration shows a magnetic frictionless gear of the screw type for an exhaust-steam turbine of 300 B.H.P. running at 3000 revolutions per minute; through this gear the power of the turbine is transmitted to the main propeller shaft driven by the reciprocating engine at a speed of 75 revolutions per minute. Such a high speed reduction is possible in this case, owing to the fact that the absence of friction between the working parts allows such high circumferential velocities as would be quite unpracticable with mechanical gearing; besides, apart from the bearings, there is no need for lubrication, and this is a point not to be despised. Unlike an electric motor, the revolving parts of the magnetic gear carry no winding whatever, so that the empty slots and helical grooves of both wheel and worm provide for a perfect cooling. The three main parts of the gear are: The field magnet M, the laminated worm W, the wheel V.

The field magnet, made of cast steel of high magnetic permeability, is of the Manchester type; its top pole-piece is laminated in order to prevent losses and heating from hysteresis and Foucault currents. The coils are wound with high conductivity copper wire properly insulated. The worm is made up of iron stampings fixed concentrically on two cast-iron spiders, in exactly the same way as the armature core of a motor or dynamo. One end of the worm shaft is coupled to the turbine. The end-thrust is either entirely or partially balanced by that of the turbine. A thrust-bearing is shown at the other end of the shaft to take the unbalanced thrust. The wheel, being subjected to a side-thrust due to the angularity of the teeth, partially relieves the thrust-blocks of the propeller shaft. The Wheel V has a hollow rim made up of sprockets of soft iron coarsely laminated; these sprockets have the same angle, width and pitch as the threads of the worm opposite which they move with a clearance of about $\frac{1}{4}$ in. This wheel is keyed on the propeller shaft driven by the reciprocating engine at 75 revolutions per minute.—To clearly understand how the tangential pull on the rim of the wheel is obtained by means of apparently perpendicular lines of force, it must be pointed out that the latter are not actually normal to the circumference of the wheel, but, owing to difference in the degree of saturation of the iron sprockets due to a slight advance of the worm threads under load, the lines of force cross the air gap at an angle, dragging the wheel in the same way as the armature of an electric motor is pulled back into the field when shifted along its centre-line.

Losses in the Magnetic Gear and Speed-reduction.—The transmission losses are, the electrical energy necessary for exciting the magnetic field and the hysteresis and Foucault-currents in the iron of the worm and wheel. *Field Excitation.*—From experiments I have made, I found that a magnetic density of 15,000 lines per square centimeter are required to give a tangential force of 22 lbs. per square inch of iron face. With a total air-gap of one centimeter, a number of ampère-turns equal to $800 \times 15 = 12{,}000$ is required for producing the necessary magneto-motive force; as there are two parallel magnetic circuits (wound in series) it will really be 24,000 ampère-turns, to which we must add 6000 ampère-turns to overcome the resistance of the iron circuit, and this brings the total to 30,000 ampère-turns. Let us now assume that the pressure of the electric supply is 120 volts, that the wire with which the coils are wound has a sectional area of ·012 square inch, to which corresponds an ohmic resistance of ·2 ohms per 1000 yards, and that we allow a current density of 1000 ampères per square inch, say, ten ampères for the section of our wire; then, 3000 turns of such wire will be necessary to give the 30,000 ampère-turns required. The length of each turn of wire being two yards, the total length of the electric circuit will be 6000 yards, whose total resistance (at two ohms per 1000 yards) is 12 ohms. The formula $R \times I = E$, in which R is the resistance of the circuit, I the intensity of the current, and E the electro-motive force, is verified: 12 ohms $\times$ 10 ampères = 120 volts. The total electrical energy corresponding to these figures is: 10 ampères $\times$ 120 volts = 1200 watts, which is less than 1 per cent. of the total power transmitted (300 H.P.).

Loss through Hysteresis and Foucault Currents.—Owing to the laminated state of the worm, and also the sprockets of the wheel, the loss through eddy-currents and hysteresis is very low and always less than 4 per cent. of the total power, which, added to the 1 per cent. of the field excitation, will give a total transmission loss of 5 per cent.

The total weight of the 300 B.H.P. gear for reducing the speed from 3000 to 75 revolutions per minute is 11 tons, of which two tons for the worm with its shaft and bearings, four tons for the wheel and five tons of the field magnet. Comparing these figures to electrical transformation, it would be in the latter case: One 250 KW dynamo at 3000 r.p.m., three tons (approximately); one 300 H.P. motor at 75 r.p.m., 27 tons (approximately); total 30 tons. The magnetic gear can run in both directions if the turbine is reversible if such is not the case, the excitation is cut off by means of a switch, and the reciprocating engine gives alone the reverse motion without the assistance of the turbine.

THE TELEMOTOR.*

By Mr. W. G. Gibbons (Member).

THE subject of this paper is an ingenious piece of mechanism which has already made some stir in the world and has come much into notice in recent years. The inventor, a great mechanical genius, unfortunately no longer with us, could not find and had to coin a word for it—Telemotor. The invention was at first regarded as altogether too scientific and refined and not to be understood by the average sea-going engineer, but if this idea is still entertained in any quarter, a small amount of study will show that the device is simplicity itself. For some years previous to 1888, the late Mr. A. B. Brown, of Rosebank Iron Works, Edinburgh, had been endeavouring to get a means of controlling steamers' steering gear from the bridge by a more efficient and more easily installed arrangement than the usual shafting, bevel wheels, Hooke's joints, ropes, etc., that were then in general use. When he brought out his well-known steam tiller, which is placed aft on the rudderhead, the drawbacks of shafting and its equivalents became more accentuated, as the distance between the steering engine and the bridge was considerably increased over what it had been before, and in addition to this, ships were being built larger and larger.

The control of gear of this description had been attempted before by hydraulic means, notably by the late Mr. Macfarlane-Gray, but in the systems tried by him and others, there was no provision for automatic correction of the position of the piston or plungers on the receiving gear against the steering engine in relation to the piston or plungers on the transmitter forward. It was, of course, quite easy to arrange two pistons or four plungers to work in unison with each other through any length of piping, provided there was no leakage from either of the pipes, or any unequal expansion or contraction of the fluid, etc.; but this, of course, is a desideratum hardly attainable, even at the present time with all the advantages of good appliances, first-class workmanship, and the best materials. Mr. A. B. Brown conceived the idea of fitting the receiving cylinder with a pair of strong springs, one on each side, as shown in figure 1. The object of these springs was to force the piston to its central position, together, of course, with the control valve or other appliances to which it was fitted, whenever the pressure on the two sides of the piston or its equivalent became equal or tended to become so. On the transmitter he formed an automatic bye-pass so arranged that when the transmitting piston was in its central position there was a free passage for the fluid from one side of the piston to the other. This device he patented in 1888 and gave it the name of "Telemotor." It will be seen that with this arrangement, whenever the transmitting piston is in its central position, the springs on the after cylinder force that cylinder and its attachments to their central position also. Whenever the piston in the transmitting cylinder is moved beyond the bye-pass limit, the fluid is then forced through the pipes on the one side and flows back on the other, so that the receiving cylinder is moved accordingly. Should, by any chance, the receiving cylinder tend to get back to its central position through leakage or other causes, while the transmitting piston is over to one side, it will always automatically

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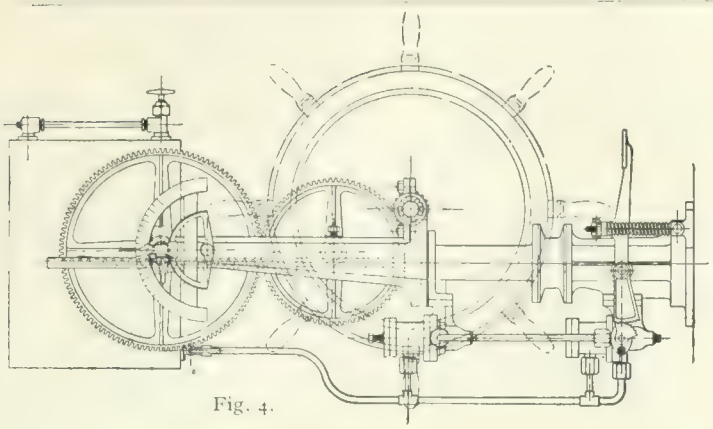


Fig. 4.

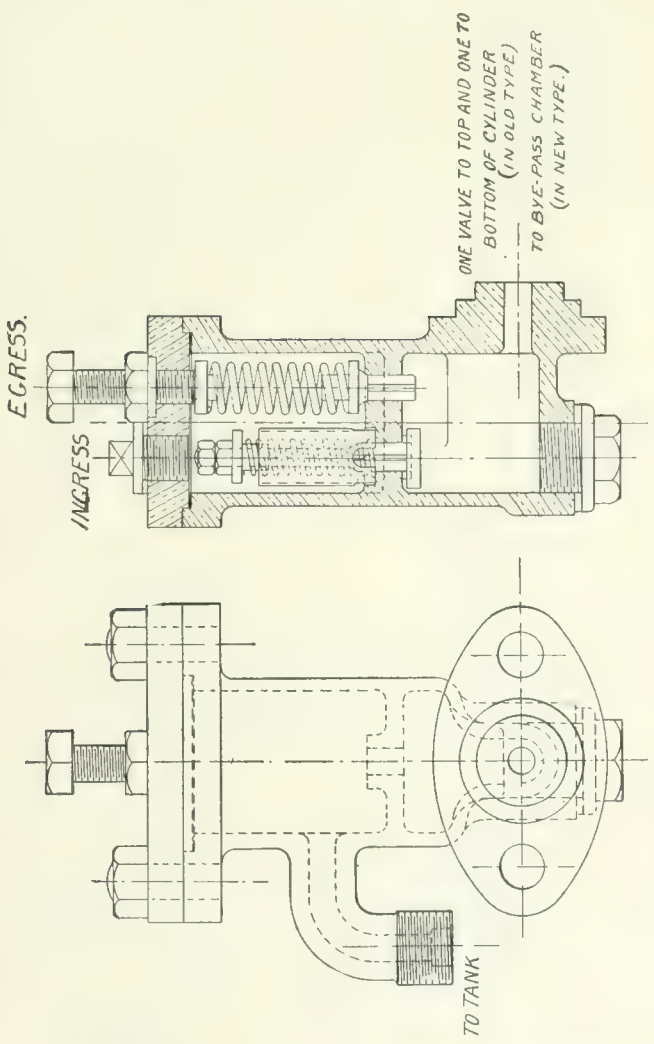


Fig. 2.

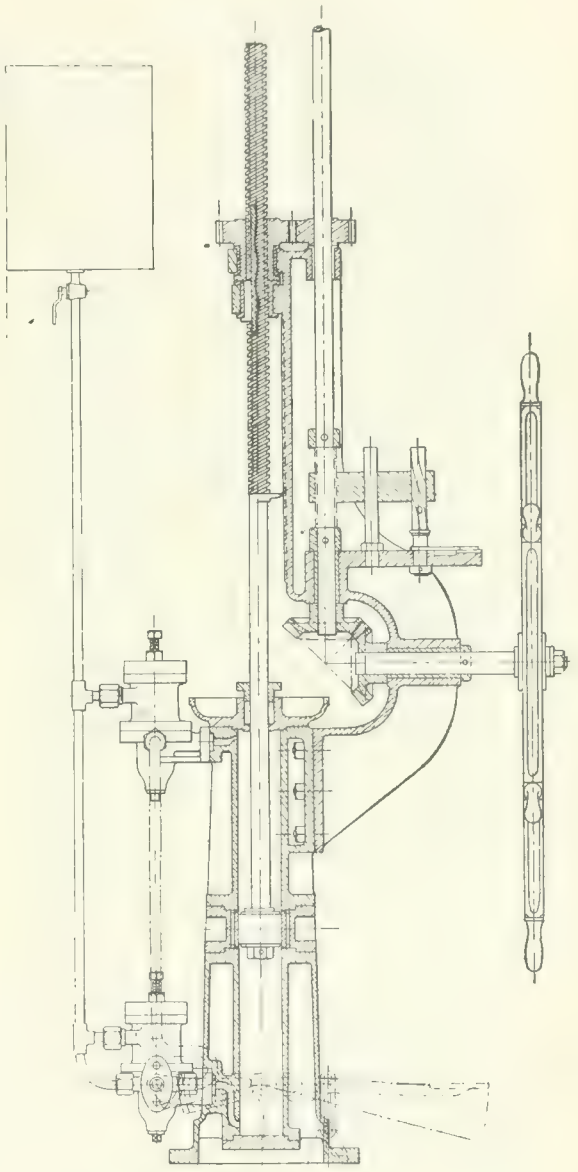


Fig. 3.

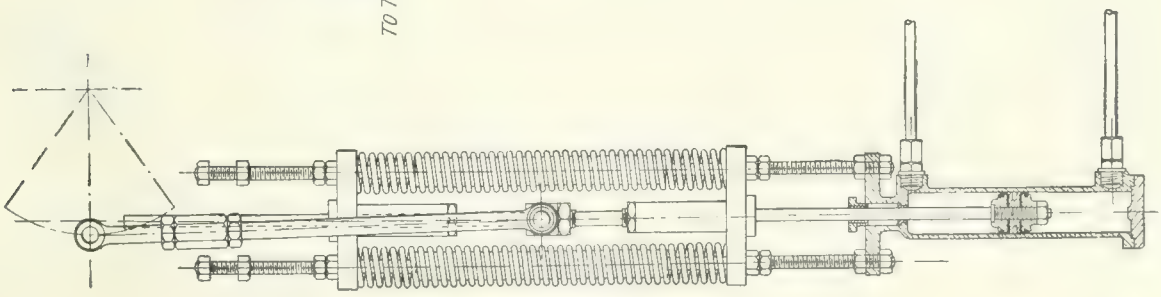


Fig. 1.

correct itself when the transmitter is put into its central or midships position. It is this ingenious arrangement that made this method of hydraulic transmission practicable. One of the advantages of the springs on the receiving cylinder is that the man at the wheel can always tell, by the resistance it offers to his effort, where the helm is; and on his letting go the wheel at any time it will always return to its central position. This is a great advantage which is very much appreciated. In one or two cases, however, that the writer has heard of, complaints were made about this feature. In these cases the ships were rather small ones, and it was the practice to frequently move them about the dock, with only an officer on the bridge. His complaint was that when he put the wheel hard over, it went back, unless he stood and held it. This difficulty was, of course, easily got over by providing two small lines secured down to the deck by brass staples, so that he could put a turn round the wheel, and thus keep it in the desired position. Any leakage from the system, and the necessary ingress and egress of fluid required owing to variations in temperature, are made up and allowed for by the non-return valves shown in figure 2.

The telemotor has passed through various stages in its development, but the original invention of Mr. A. B. Brown remains the same in principle. The first really practical form of telemotor made is shown in figure 3. There were not many of these manufactured, their drawback being the great friction of the screw and nut that were used for reciprocating the transmitting piston. They were nearly all taken out after a time, and replaced by more recent ones—with the exception of one which was at work from 1890 up till less than two years ago, when it was removed and one of the latest and most improved type fitted in its place. So far as could be learnt at the time, the old telemotor had done very well, but it was getting greatly worn, and the owners wished to have the latest. The next type of telemotor is that shown in figure 4. Some of these are at work now, after a good many years' service, the first of them having been sent out in 1891. This type was closely followed in 1892 by that shown in figure 5, a large number of which are still at work. While this type of telemotor was being made, it was considered by the inventor that it would be a great advantage to place the compensating or inlet and outlet valves on the bye-pass piece of the transmitter, the object of this being to prevent any leakage from these valves affecting the working of the telemotor. It will be noticed from the illustration that when the transmitting piston moves beyond the bye-pass, the side of the installation that is being put under pressure is "cut off" from the compensating valves, so that should these latter be leaky or defective in any way, they do not affect the working of the telemotor. As a matter of fact, provided the tank connected to the valves were placed at a considerable height above the telemotor top, the valves could be dispensed with altogether, and the telemotor would work quite satisfactorily.

The next great change was in 1898 when the design shown in figure 6 was evolved and manufactured. The great feature of this type was the ingenious epicycloidal gear that was employed to transmit the motion of the hand wheel to the main spindle that drives the rack, the idea being to do away with any driving strain on the spindle, and at the same time make the gear as neat and compact as possible. This type of telemotor was called the Admiralty type, owing to its being at that time very extensively adopted by the British Admiralty for warships. A very important advantage in this new type of transmitter was that, there being no piston rod passing out through the cylinder that had a reciprocating motion, it was possible to connect either end of this transmitting cylinder to either end of the receiving cylinder, the latter, of course, being fitted with a tail rod to equalize the displacement of the piston rod at its other end. This is very useful in practice as it makes all the cylinders interchangeable so far as this point is concerned, and they can be turned about to suit the arrangement of the gear. Should the piston rods require to be trued up at any time (which we have never known to be necessary except through an accident) provided the tail rod and piston rod are kept of the same diameter, no trouble is caused. With the old arrangement, the two piston rods had, of course, to be of the same relative displacement, so that if the cylinders were of different diameters (as generally made), and there was equal wear or an equal amount turned off the diameter of each rod at any time, the true relation of movement of the transmitting and receiving pistons would be affected. This type was in use up till 1905 when it was considered that the transmitting and receiving cylinders could be very much reduced in size with advantage, and the design shown in figure 7 was adopted, the only difference other than size being the new arrangement of gearing for driving the main spindle. Then trouble was experienced in getting the two springs on the receiving cylinder to exert the same resistance through such a large range as they have to work, *viz.*, 6 in. each way. Therefore the arrangement shown in figure 8 was introduced. In this type of receiving cylinder, there is only one spring, which is of very much larger diameter than the old springs, and is placed co-axially with the piston rod; the result being that there is no cross-winding or tendency of the crosshead to get out of line, as there was in the old double spring arrangement, With the single spring, moreover, the factor of safety is increased from three to four with the old arrangement, to over twelve, and the resistance of the large spring goes up only 50 per cent. at hardover, against an increase of 100 per cent. or more with the two springs. It will be seen that this is a great advantage, as it is the minimum power of the spring that has to be relied upon to bring everything to the central position, when the pressure is equal on both sides of the receiving piston, or tending to become equal. Any reduction in the maximum power at hardover, of course, means less wear and tear, less liability to leakage (as the pressure in the system is, of course, reduced), and last but not least, less work for the man at the wheel. This single spring arrangement was introduced early in 1907.

It was generally found that the leathers in the transmitting cylinder wore out and became ineffective much sooner than those in the receiving cylinder, the principal cause of this being that the edges of the leathers were liable to catch on the bye-pass opening. This bye-pass was formed, as shown in figure 9, by an opening extending right round the cylinder, about $\frac{3}{32}$ in. wide, with a radius on its edges. To get over the trouble, a new form of bye-pass was brought out in 1908. This is shown in figure 10. It will be noticed that the new bye-pass consists of two parallel rows of small holes $\frac{1}{16}$ in. dia., and $\frac{1}{4}$ in. apart, as shown in the illustration. With this arrangement it is really impossible for the leathers to catch in the bye-pass openings, as the small holes are slightly countersunk on the working face of the cylinder.

This has proved in practice to be fully as successful as was anticipated, and the life of the leathers in the transmitting piston is now increased to four or five times what it was before. The drilling and countersinking of these bye-pass holes is done by means of a special machine designed for the purpose, and no trouble is experienced in doing it. Since the men have got accustomed to this work, they are able to drill a number of telemotors with the one drill, without accident. At first, a little trouble was experienced through the breaking of the drills, but this has now been entirely got over. Another great advantage now is that the cylinder, being all in one piece, is in perfect alignment, whereas with the old cylinder in two or three parts, there was always the possibility of the parts being out of truth with each other, either when put together originally, or after being taken to pieces and not put back properly.

The telemotor and receiving cylinder, as shown in figure 11, are now standard types, and are exclusively adopted by the British Admiralty and the leading steamship owners. Up till just recently, a small spring of the Ramsbottom piston type has been fitted inside the leathers to keep them expanded against the cylinder sides at all times. These have naturally a very limited range of spring. They generally put far too much pressure on the leathers to start with, and after very little wear they, of course, become slack. An important improvement has recently been made, *viz.*, a new design of spring which gives promise of very beneficial results. In the standard type adopted, there are six segments with spiral springs to each one, arranged so as to press the leather out against the cylinder faces. These springs are arranged to be much lighter on the leather when it is new, and they follow it up much better. The springs are so restricted that they just cannot reach the cylinder sides themselves. This new form of piston is at present under trial, and so far it has given the most satisfactory results, the leathers being quite tight against leakage and very much freer in working. It is hoped that the leathers will be made to last nearly as long as the ship itself. It will be noticed that both the receiving and transmitting cylinders are now of the same diameter, and the

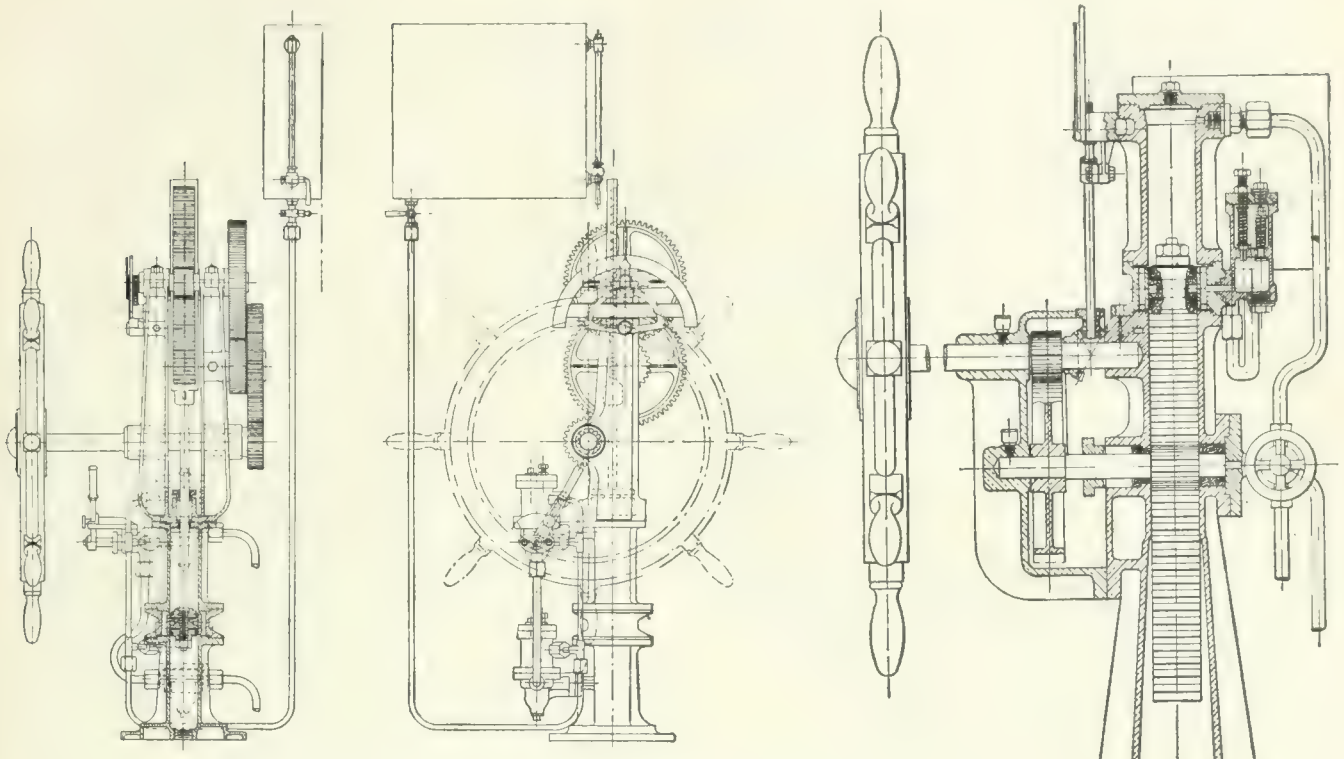


Fig. 5

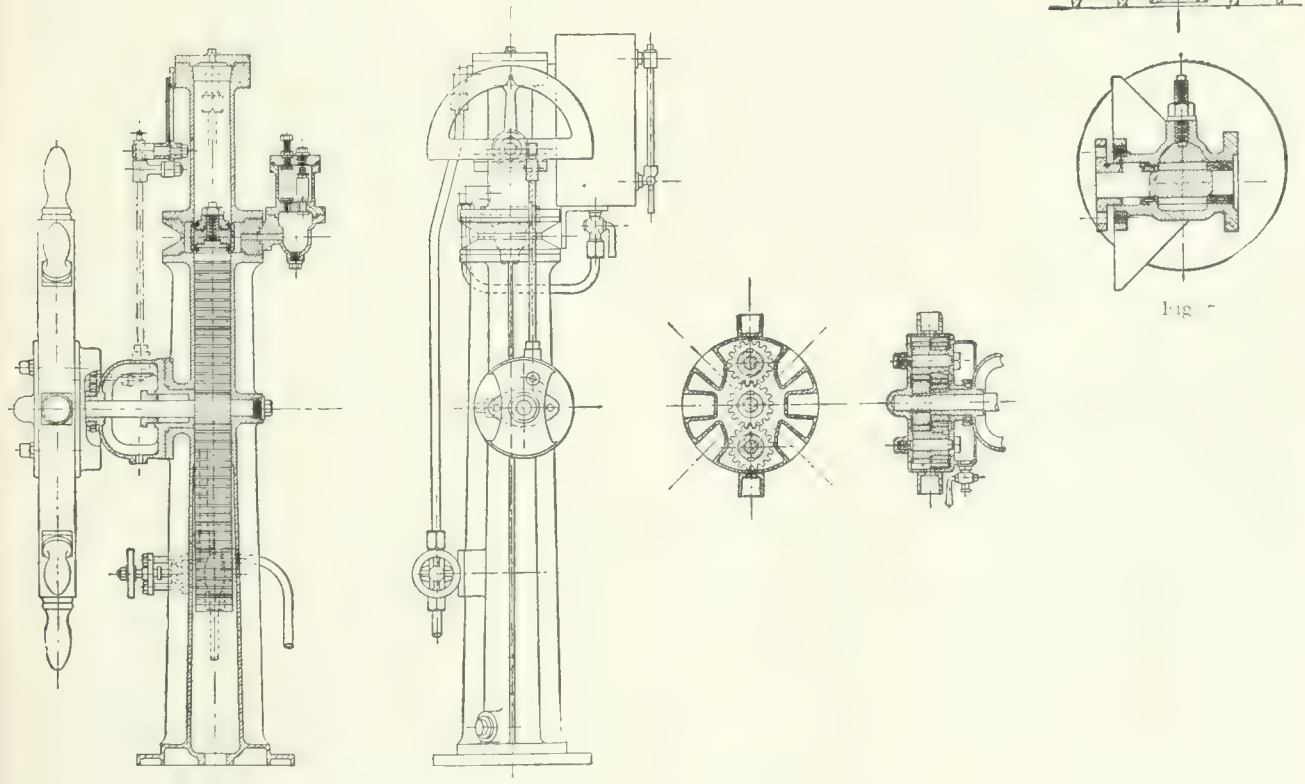


Fig. 6.

leathers, springs, etc., are consequently interchangeable, so that the amount of spare leathers to be carried is reduced to the minimum.

It will be observed that the evolution of the telemotor is the result of practical experience, and, to a great extent, the outcome of experiments made to overcome various difficulties which have arisen from time to time in actual practice. This is no doubt the history of almost every highly perfected invention. The material used for the manufacture of these cylinders, etc., is bronze, considerably harder than the standard Admiralty gun metal, so as to get a very hard, close-grained, smooth face for the leathers to work on. The toothed gearing is all machine cut, and there is nothing about the transmitter that is magnetic or can affect the ship's compasses. The indicator or pointer is of the ordinary design, arranged so as to show the position of the after or receiving gear, which it does very faithfully, provided there is no leakage or other defect in the installation. On the dial, it will be noticed that the degrees do not extend more than two-thirds of the distance to the hardover position. The idea of this 50 per cent. extra stroke is to provide a reserve in the transmitter of that amount in case there should be any leakage, so that the rudder can be kept hardover for a considerable period, even when there is a fair amount of leakage, the after gear correcting itself automatically again when the transmitter goes into the central position, as previously explained. The transmitting and receiving cylinders are connected by means of small bore copper pipes. In the smaller class of ships these are $\frac{3}{8}$ in. bore ; in larger ships $\frac{1}{2}$ in., and in the largest $\frac{5}{8}$ in. The pipes employed for this purpose are solid drawn, of the highest quality of copper. They are connected together by a special form of coupling that has been in use now for the last twenty years with every success. A section of this coupling is shown in figure 12. It will be seen that these pipes can be easily led through parts of the ship where it would, in some cases, be impossible, and in others, very awkward to lead shafting and its equivalents. There is no oiling or other attention required, and the danger of anything getting caught in bevel wheels, by couplings, or wrapped round a shaft, is entirely obviated. Provided the pipes are protected from mechanical damage and very great heat, no harm will come to them. In the case of some warships, where the receiving cylinders have to be placed in a very hot part of the engine-room, water jackets are fitted to the cylinders, with arrangements for circulating cold water through them so as to prevent any damage to the leathers from excessive heat. If more than one telemotor or receiving cylinder is fitted to a ship, the provision for connecting and cross-connecting the transmitters and receivers is easily made by means of valves. It is practically impossible to get an air lock in the pipes under anything like ordinary conditions, as the bore of the pipes is so small that all air is forced out when charging up. This charging up is effected by means of the pump and connections shown in figure 13. The usual practice when the telemotor is first erected on board the ship is to disconnect the inlet pipe from the telemotor and pump clean water through it so as to clear out any dirt. When certain that it is clean, the pipe is connected again to the transmitter. The pipe from the transmitter is then disconnected from the receiving cylinder aft, and washed out thoroughly in the same manner. This pipe is then connected up again and the system charged with pure condensed steam (which is preferable to any other water) for climates where no frost or danger of frost is to be feared, or in colder climates, with a mixture of glycerine and water so as to prevent freezing. The usual proportion adopted is one of glycerine to two of water. A table of the freezing temperatures of different mixtures of glycerine and water is given in the book of instructions, issued with each of the telemotors. When running, it is only necessary to see that the supply tank on the transmitter forward is kept about half full of the same mixture as is put into the system. It will be found that the level in this tank varies from day to day or even from hour to hour, but so long as it remains about half full, there is no need to add any more. If there is no external leakage about the glands or anywhere, it will be found that very little loss of fluid takes place.

With each telemotor installation, a glycerometer and thermometer are now supplied, so that the proportion of glycerine in the fluid can be ascertained at any time. Trouble has been experienced sometimes owing to the telemotor getting very stiff, due to too great a proportion of glycerine being used. This was quite excusable to a great extent, as, of course, those in charge were anxious that the proportion of glycerine should not fall too low, and not always knowing just how the proportion stood, they added glycerine from time to time until the proportion became excessive. The glycerine used is known as " Commercially pure, white glycerine," and it has a specific gravity of 1260. When testing telemotors in the shops, it is found that they stand at hardover or any intermediate position on either side, for periods varying from twelve to forty-eight hours, without any perceptible movement of the receiving cylinder towards the centre, and in practice on board ship we frequently find them standing about as long—in fact there are records of them standing even longer than that.

As, in steering a ship, the wheel is always more or less passing through the central or midships position, the two pistons get very little, if any, out of their correct relative positions, the centring of the wheel always correcting them even if they are a little out. There is a bye-pass valve fitted to the telemotor, which replaces a cock in the older designs. The object of this valve or cock is to enable the man at the wheel to pull his wheel back to midships, if the after gear should have got back and out of its relative position through leakages, etc., without moving the after piston at all. The advantage of this valve is, of course, that, should there be a small leakage in the system and the wheel be kept over, say, to port with the receiving cylinder coming back through this leakage to midships, then by opening the valve the wheel can be brought back to midships without moving the after cylinder over to starboard. It will be readily appreciated that in a case where the after gear had gradually moved back to the centre position through leakage, with the wheel forward still, say, at hardover, this valve is of considerable advantage ; for without it, pulling back of the wheel forward would send the after gear over to the other side, and this might prove very awkward at certain times, say when near the land or with a ship close by on one side. Once the two pistons have regained their correct relative positions at the centre, the valve must, of course, be shut before steering can be resumed. As a matter of fact, this valve is hardly ever used, but it is thought advisable to retain it. Another use to which it can be put with advantage is in port, when the valve should be left open, so that when any one moves the wheel either during cleaning, or for any other reason, nothing is moved aft at the receiving gear, so that no strain is put on the gear there, or damage done to any one's fingers who may be employed about the gear. In ships where another steering station is required, either above or below the telemotor, provision for this is frequently made by means of an ordinary brass standard, connected to the telemotor by shafting, a clutch being provided for throwing this standard in and out of gear. The friction with telemotor control is so small compared with shafting and its equivalents that it is possible for an ordinary man, putting a fair amount of force on the wheel, to exert a pull of not less than four tons on the after piston rod, and through it on the connecting rods to the steering engine control gear. This has, in fact, got the telemotor into trouble on certain occasions, through no fault of its own, owing to people forcing the wheel round when steam was shut off the steering gear or the steering engine unable to respond, with the result that the control valve or its gear came up against its stops. Not many control valves and gear are made to be capable of resisting a pull of four or five tons, with the result that with some designs, they have been either broken or bent in such cases.

In 1907 we brought out a new patent control gear, which is now applied to all our steam tillers and which has completely solved the trouble so far as this steering gear is concerned ; and at the same time it has given a very much finer control of the steering engine. It is really a form of the Stanhope lever, so arranged that when the valve is at or near its central position, its movement is very fast in proportion to the movement of the telemotor ; but as the valve gets wide open either way, the motion slows down in relation to the movement of the telemotor, with the result that the wheel can go from hardover to hardover without reaching any stops on the control valve or its gear, the strong stops on the receiving cylinder taking all the strain, as they are well capable of doing. With the standard steam tillers as now supplied it is easily possible to move the wheel on the telemotor one degree and the engine and tiller will respond to

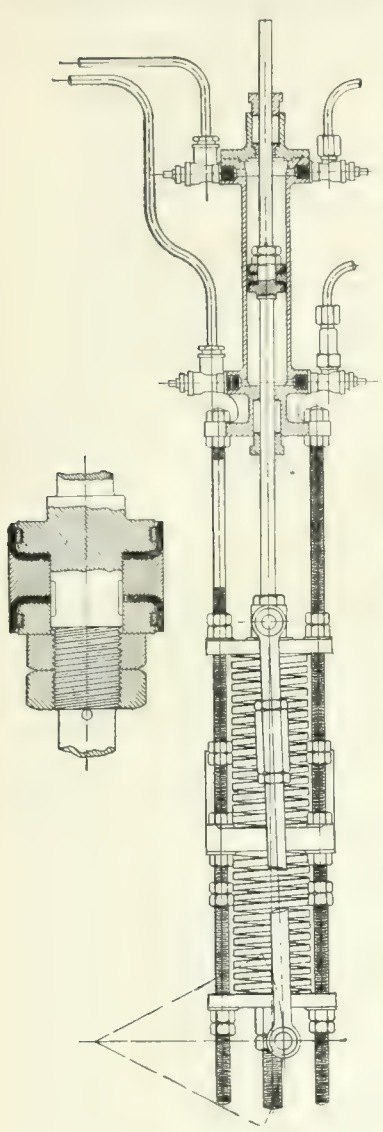
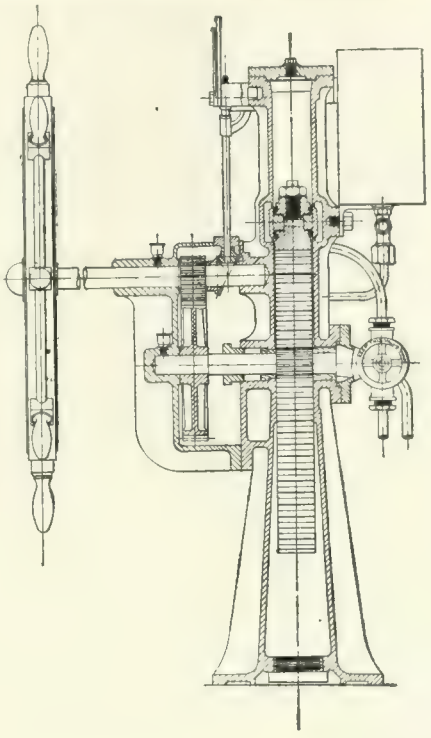


Fig. 8.



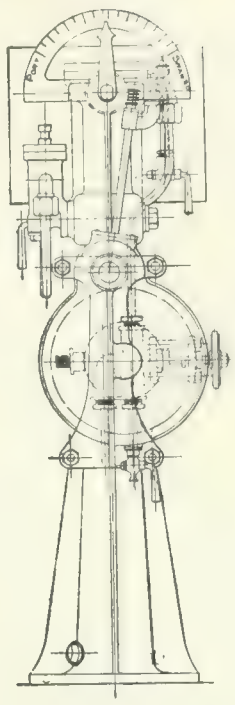


Fig. 11.

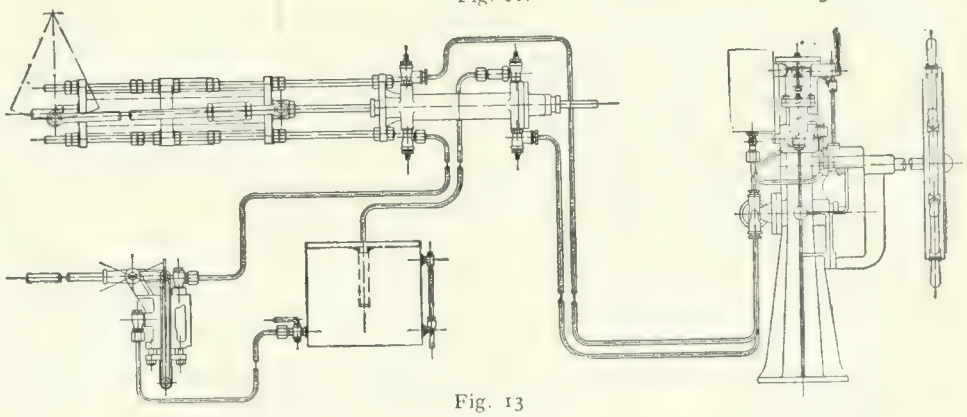


Fig. 13

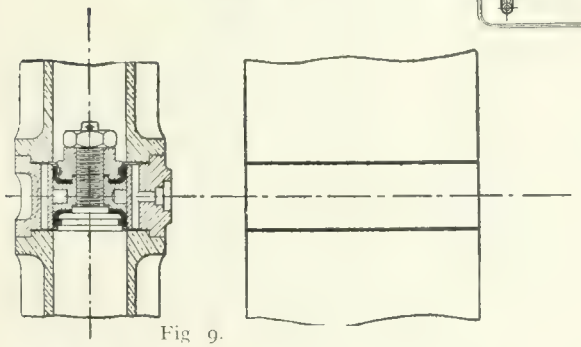
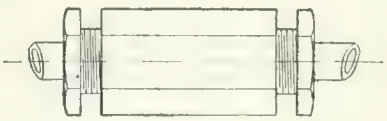


Fig. 9.



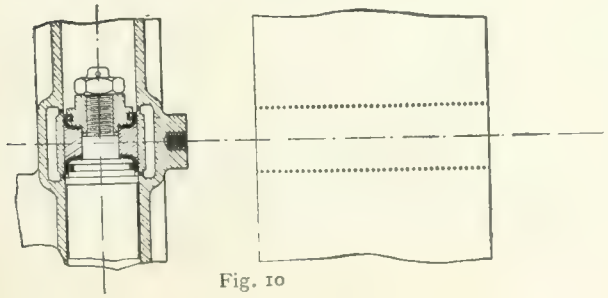


Fig. 10

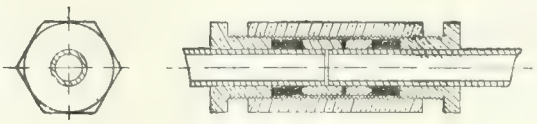


Fig. 12.

it. This is generally considered very fine steering indeed. With this arrangement there is a little lap on the piston valve, but the leakage of steam when the engine is standing is really prevented by the patent economic valve. This leakage of steam is prevented in a good many cases by putting considerable lap on the piston valve and/or fitting a form of economic valve; but when the lap is put on the piston valve, the result, as you will be aware, is to make the gear anything but sensitive in responding to the movement of the steering wheel.

A few words on the commercial aspect may be of interest. An inventor gets a monopoly for fourteen years, during which period he is surely entitled to make provision for his old age. Consequently the price of the article retards its extensive use. When the patent expires, it is to be expected that the price will fall, as the manufacture is then open. But in the meantime, improvements are made the object of more patents, and these give the original makers still an advantage. In these times, however, cheapness seems to be the main consideration, the consequence being that the price of the telemotor in its most up-to-date form is ruled practically by the price at which it can be bought unimproved.

I trust this little resumé of the life history and "Present position of the Art," as patent lawyers say, will be of interest to the members, as a good many of them will, I feel sure, either have to deal with or be sailing in ships where a telemotor is fitted. In writing a paper about a speciality with which one is intimately connected, in regard to its improvement, production and sale, it is difficult to avoid giving the paper the appearance of an attempt to obtain a cheap advertisement, but in my case, when asked by our secretary to put forward a paper on something that would be of interest to the members, the telemotor appeared to me to be at present the most interesting subject I could put before you.

THE INTERNAL COMBUSTION ENGINE.*

By Mr. William P. Durtnall (Member).

PART I.

LOOKING backward, it is very evident that the engineer, chemist and metallurgist have, during the last few centuries, brought out wonderful ideas and inventions in the advance of engineering science, until to-day our very existence is dependent upon it. If we had lived in the time of the Black Prince (1346), and had been present at the battle of Crecy, strange noises would have been evident to us. We should have heard a loud, deep report, not only the sound of charging cavalry or the clash of steel, but the thunder of cannon, heard for the first time in warfare. Gunpowder, or the internal combustion of gaseous materials, was being used for the first time in the production of power, and was largely instrumental in bringing about that great English victory.

Another victory of more modern times is now at hand, and that is the practical application of the internal combustion engine for the production of mechanical power. A hundred years ago steam was in its infancy, but its use revolutionized the commercial world, brought the distant near, made travel to the multitude possible, added comfort all round, cheapened all kinds of goods, made, in fact, the world a better place to live in. Why is all this? Is not the whole matter of the production and application of steam for power or other purposes a great and interesting chemical and physical experiment, utilized so successfully by the engineer for the benefit of the community? And although to-day the steam engine is a fine piece of mechanism and does good work in many directions, its efficiency as regards the amount of actual work per unit of fuel that can be recovered, when compared with what is possible by burning the fuel in the way of gas in the cylinders direct, is very low.

On examination it will soon be evident to the investigator that the dynamic principles involved in the internal combustion engine are, after all, very similar to that as found in the gun. Figure 1 shows a diagram of such; it will be observed that the pressure generated by the burning of explosive mixture rises enormously per square inch soon after the point of ignition, to, in fact, 31 tons in this particular gun, as soon as the projectile begins to move; it will also be observed how the velocity of the projectile has risen to 1180 feet per second, by taking advantage of the mechanical energy so generated and during expansion from the above pressure to 1·6 tons at the muzzle. It will be noticed that, owing to enormous pressure produced by the burning of the powder, the combustion chamber is constructed of great thickness and of consequent heavy weight, and represents a 12-inch 25-ton gun as constructed in 1869. Since then great improvements have taken place in the design and detail of guns with a view of reducing weight and increasing the velocity at which projectiles are made to leave the gun muzzles. Figure 2 shows a similar 10-inch 25-ton gun, constructed in 1884. It can be noticed that the charge is so arranged that, instead of a rapid rise in pressure as given in the earlier 12-inch gun, the principle of constant pressure combustion is adopted, insomuch that the pressure only rises to 17 tons per square inch during the burning of the charge, which enables a lighter gun to be produced; also that by increasing the length of the gun, the pressure follows the projectile up to such degree that it issues from the muzzle at a velocity of 2225 feet per second, and that owing to the smaller bore, the pressure falls to only 5·2 tons, which no doubt increased the noise that such a gun made in actions. Of course the amount of velocity impressed on projectile is the important thing aimed at, as every student of mechanics will easily understand, but, in the above, we have the analogy to the early and modern internal combustion engines, where coal or oil gas is selected and used in the place of gunpowder to generate the pressure necessary for power.

Many ingenious attempts were from time to time employed to produce a satisfactory engine using gunpowder as the producer of pressure, but owing to the difficulty of safely arranging the supply in sufficient and regular quantities, the idea was dropped until 1860, when a French engineer, named Lenoir, took out patents for an engine that gave a great impetus to the design and actual construction of the internal combustion engine for industrial purposes. This invention consisted of the application of inflammable gas, mixed with a proper proportion of atmospheric air, and ignited inside a working cylinder by aid of electricity; the rise of pressure and the expansion imparting motion to a piston, which was coupled to a crank-shaft in the usual manner, as applied at that time with steam engines. It is interesting to note that even then, fifty years ago, electricity was recognised as being very suitable for ignition purposes, insomuch that the timing of the ignition of the gases could be brought about at the right instant at either end of the stroke, and at the right time to enable the maximum of expansion to take place in the production of work for a given fuel consumption, and at the same time to reduce the pressure as low as possible before opening the exhaust port to the atmosphere. Figure 3 shows this engine. The gas was supplied by means of the double forked pipe shown, R and S, which delivered gas to the orifices marked O and B. The air came in through the inlet marked A. It will be seen that the slide LM acts as the admission valve to both the gas and the air, and forms the equivalent of the modern carburetter or mixer as it is sometimes called. The exhaust is taken charge of by a separate valve shown at NT, delivering the products of combustion to the atmosphere by way of passage E. There is no question that, had Lenoir so constructed his engine that both air and gas were externally put under pressure, the engine would have been a self-starting one, and reversible with link motion as with steam engines. Many of the above engines were sold, but only of small power. They ranged from ½ to 4 B.H.P., and in the Vol. 51 of the 3rd series of the Journal of the Franklin Institute some interesting diagrams taken from these pioneer internal combustion engines are to be found. A curve which is set out in the diagram is interesting, but at the same time is not, strictly speaking, perfect, insomuch that no scale of pressures is given, although the particulars given are at least instructive. Figure 4 shows this curve. The atmospheric line is shown at A, to B, and shows the stroke of the engine. The charge is drawn in at atmospheric pressure, and it will be seen that the pressure, no doubt

*Read at the meeting of The Institute of Marine Engineers, held at the Naval, Mercantile Marine and General Engineering Exhibition, Saturday, September 17th. Chairman, Sir David Gill, K.C.B., etc.

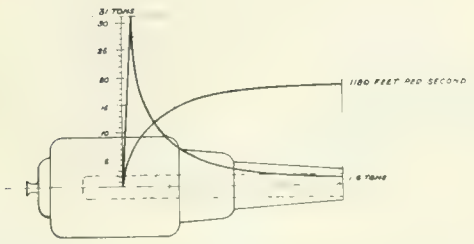


Fig. 1.

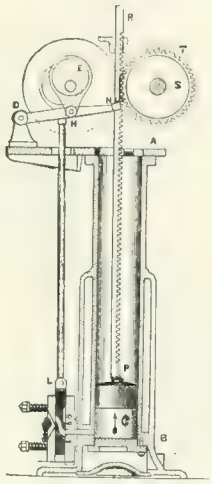
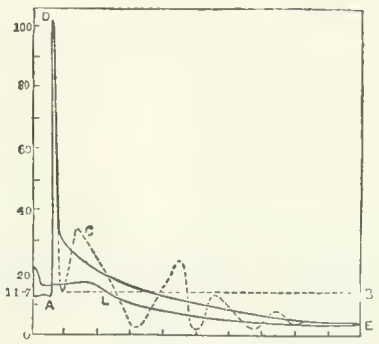


Fig. 5.



The above shows an Indicator Card taken from an atmospheric Internal Combustion Engine.

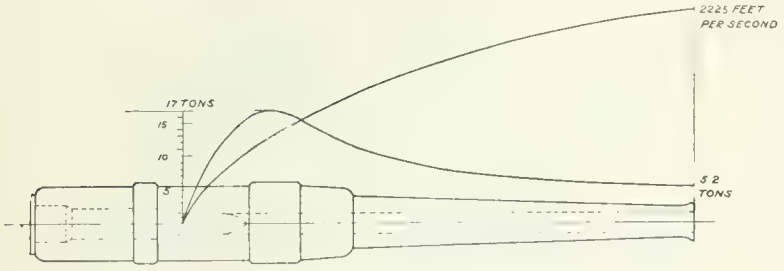


Fig. 2.

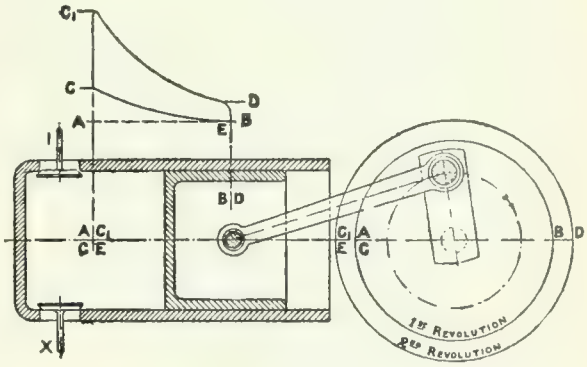


Fig. 6.

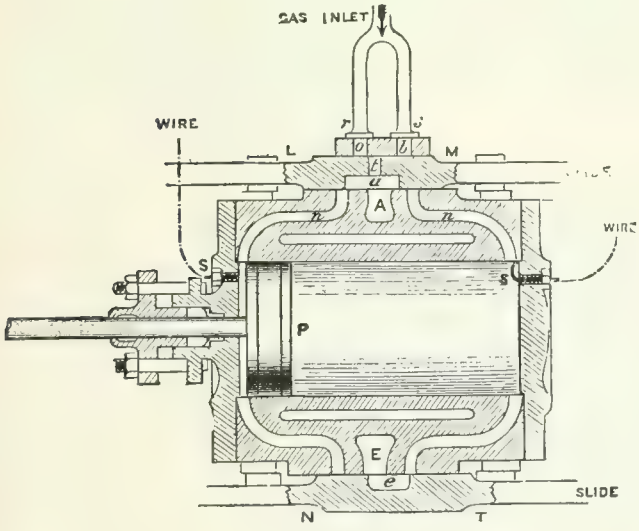


Fig. 3.

Fig. 7.

This diagram is an average good card, showing, however, some slight fluctuations in the lines. The explosion line is from C to A, the expansion from A to B, the exhaust at B. The suction stroke generally approximates the atmospheric line, from which the curve of compression rises to C.

Fig. 4.

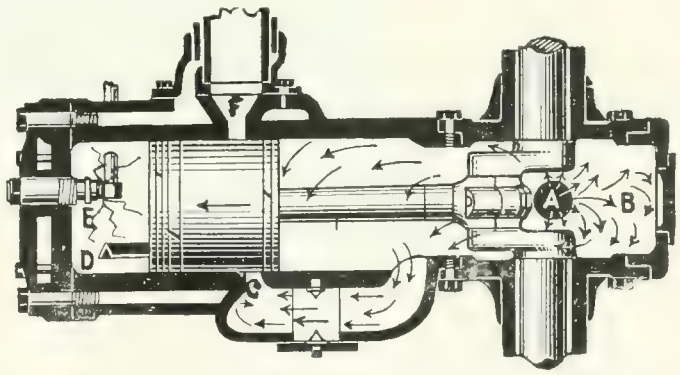


Fig. 8.

owing to small valve ways and passages, falls to about 11 lbs. above vacuum, just before ignition; it then rises rapidly (as in the gun) to 48 lbs. per square inch. The expansion, as shown on the diagram, then tells its own story. It was stated that the engine ran at 50 r.p.m., and that the cylinder was 8⅝ inch in diameter, with a stroke of 16¾ inch. The principles involved in this, the father of practical internal combustion engines, are, however, to be found in even the engines of to-day, and will, no doubt, be vastly improved on as the demand for large-powered internal combustion engines rises, especially in marine and other large applications of mechanical power. Engineers, always on the look-out for improvement in efficiency, soon began to realize that the last word had not been said in the matter of internal combustion engines, with the result that in Germany and England another interesting experiment was made in the production of power by internal combustion principles, and what is called an atmospheric engine was produced. This certainly had merits, and, in the author's opinion, much research work will result in further uses of principles involved.

By referring to the diagram of the Lenoir engine it will be observed that the expansion is cut short by the opening of the exhaust valve to atmosphere, and that the energy represented in the remaining part of the possible expansion is consequently lost, with the result that the gas consumption per B.H.P. developed on the crank shaft was about 90 feet per hour, or more than four times the amount of gas used by the modern gas engine. This was no doubt due to the fact that, as will be observed, the great advantage of compression was, in those engines, not utilized.

In 1866, however, Messrs. Otto & Langen brought out their atmospheric engine, shown in Figure 5. In this engine the gas consumption per B.H.P. hour was reduced so considerably that the Lenoir engine went out immediately. Although about 400 of these engines were sold and put to work in France, and about 150 in England, immediately the atmospheric engine was brought out the sale stopped, because of the fact that it was found that the gas consumption of the latter atmospheric engine was only 40 cubic feet per

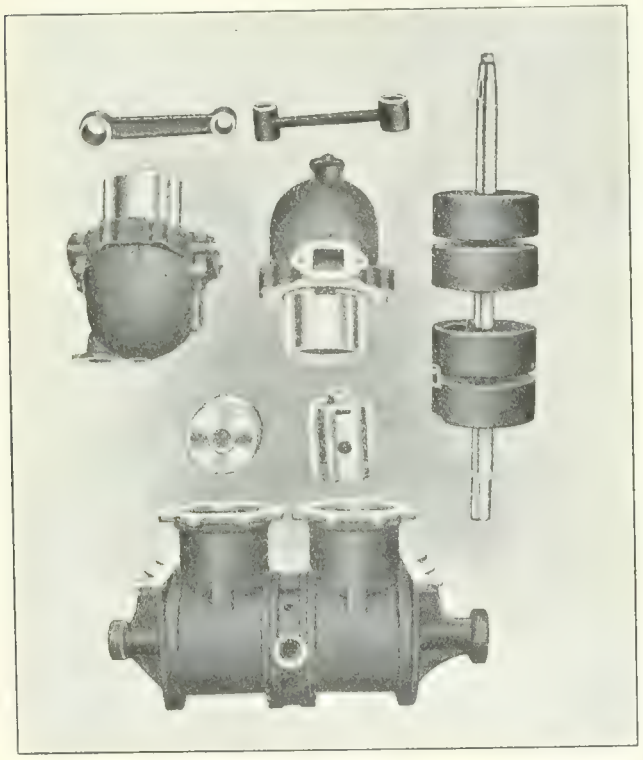


Fig. 9.

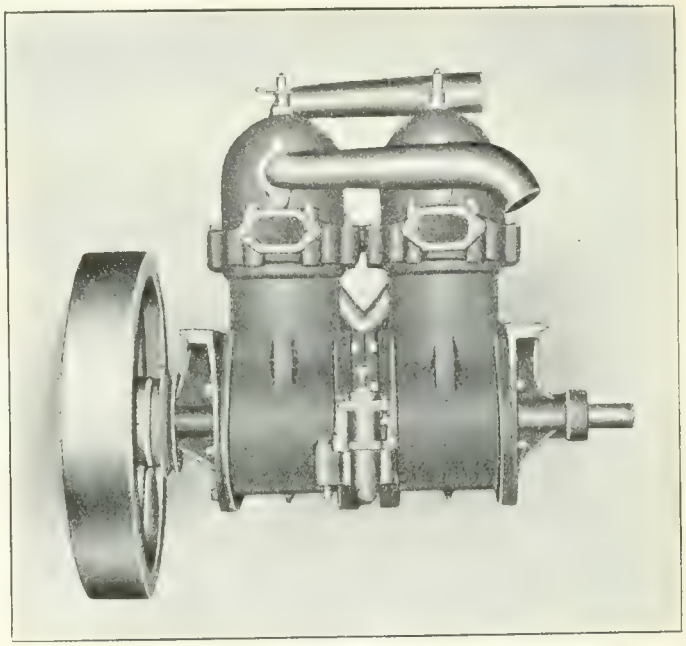
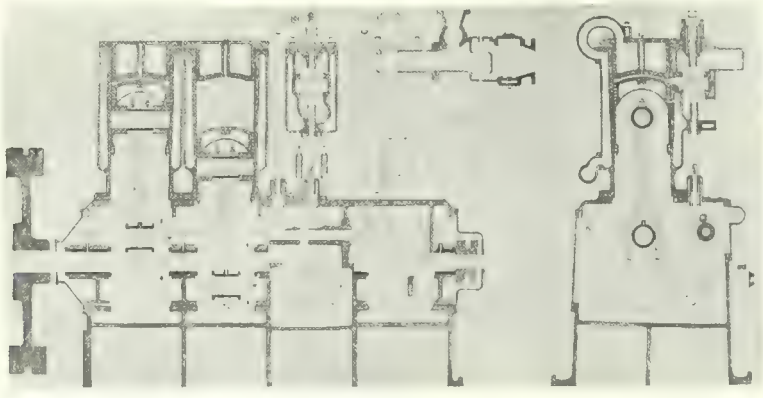


Fig. 10



In reference to the off setting of cylinders in the direction of rotation, the above marine engine by Messrs. E. S. Hindley & Sons, of Bourton and London, shows interesting detail of these engines. They are of the 4-cycle principle and have a very quiet movemen· with a minimum of vibration.

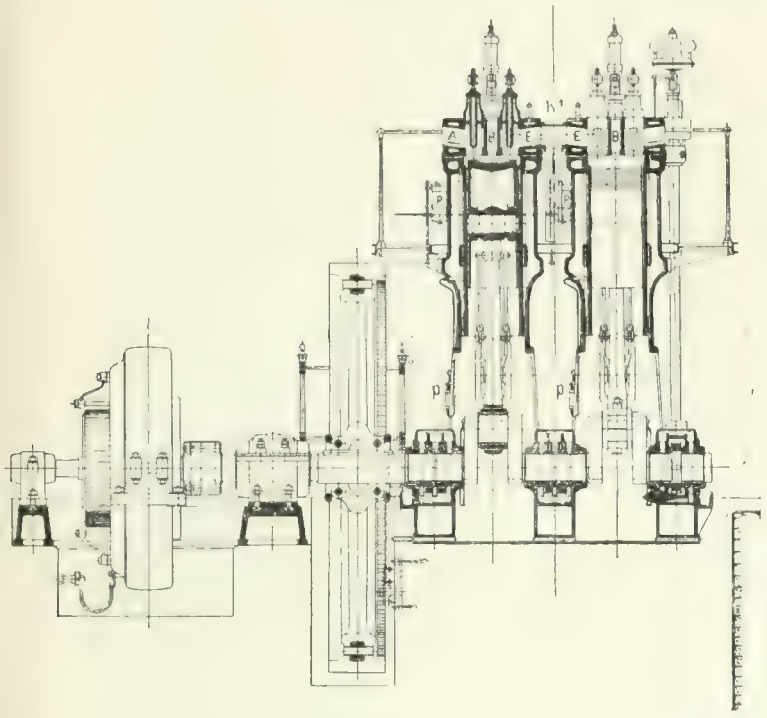


Fig. 11.

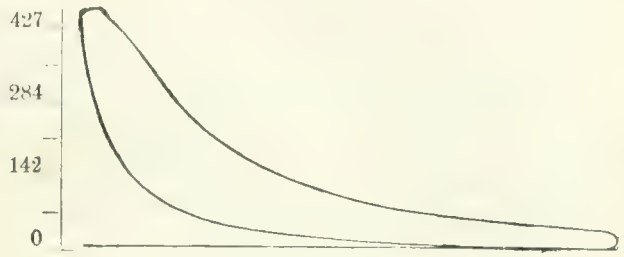


Fig. 13.

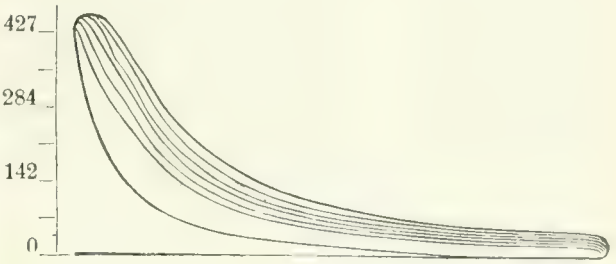


Fig. 14.

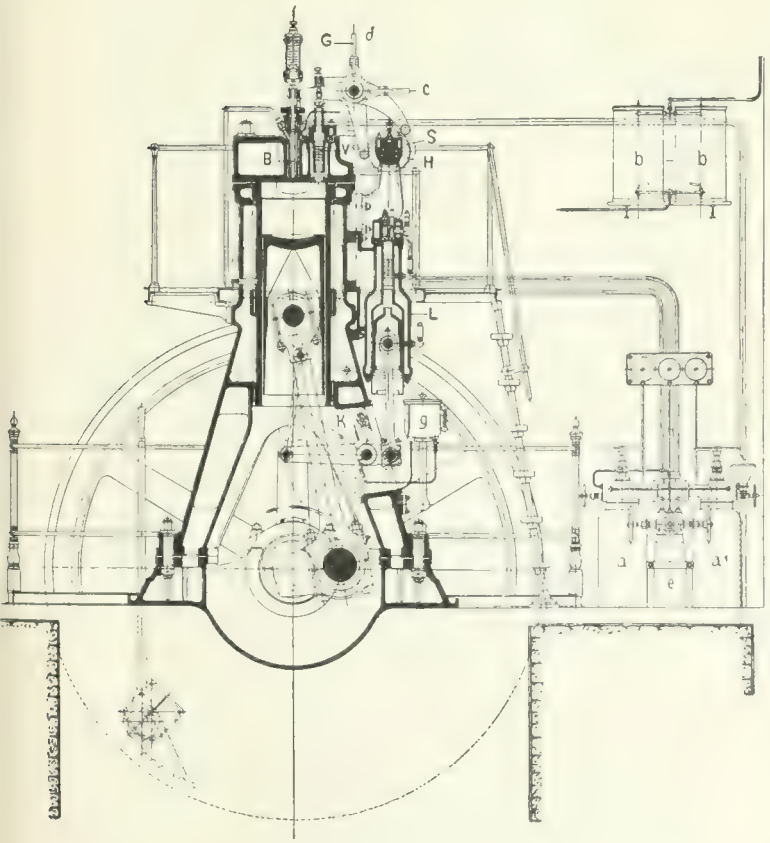


Fig. 12.

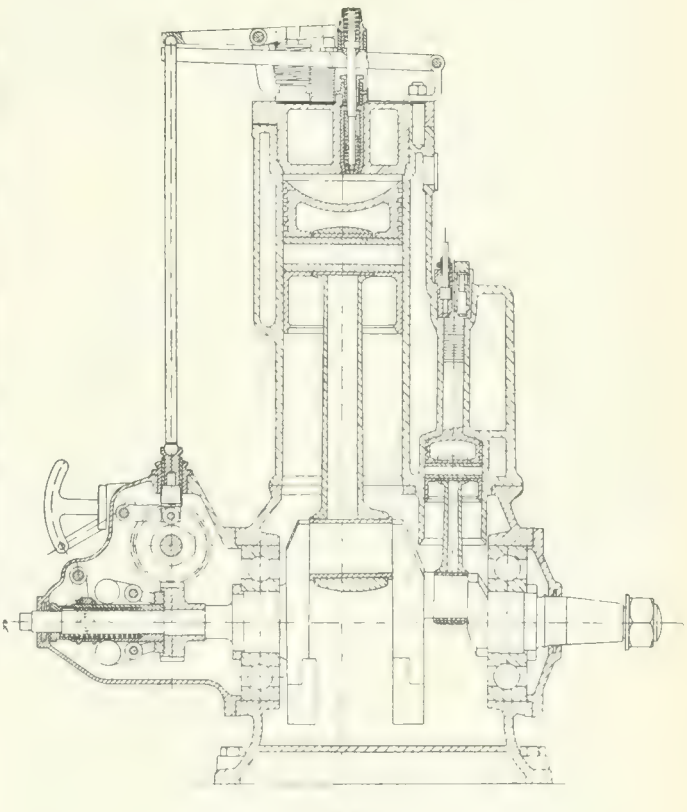


Fig. 15.

B.H.P. hour. As will be seen by Figure 5, the enigne was a vertical one, and formed, practically speaking, a gun. The piston acted as a projectile, and was not connected to the crank shaft of the engine on the working stroke. There were many good points about it as an atmospheric engine, that is, an engine with an open cylinder in which the piston is driven up by means of the explosion (as in the gun). Full advantage of the completion of expansion of the pressure was taken, and also the momentum of the weight of the moving piston, with the result that the gases became cooled. The pressure inside the cylinder was also below atmospheric pressure, the piston being constructed in the form of a large weight, and at the same time having the atmospheric pressure behind it, as soon as expansion had gone as far as practicable, the piston immediately began to descend. It was then geared through a rack and pinion to the flywheel shaft. This engine worked very economically, and was a great advance, but it relied, as in the old steam engines, on atmospheric pressure for mechanical energy, and was thus limited in its application, at the same time being, like the previous engine, very heavy per B.H.P. developed. The constructional details of the engine were as follows :—A is the working barrel or cylinder ; B is the water cooling jacket ; C is the combustion chamber in which the explosive mixture of gas and air is drawn ; P is the weight which also forms the piston ; and R is the rack which is disengaged with the wheel during the out or working stroke. The working was as follows :— The piston was raised to about 1/11th of the working stroke, and sucked in the explosive mixture ; the charge was then fired, the engine being really a gun, standing vertically, with open mouth pointing upwards. The charge, however, was not sufficient to force the piston out of the end, but only to send it to, approximately, the end of the cylinder. It should be understood that S is the main shaft attached to fly-wheel, and although P and R are always in gear with the spur-wheel T, riding on shaft S, yet inside the wheel (not shown) is a friction clutch, whereby T runs loose on the shaft S on the up-stroke, but is immediately in gear on the down stroke. In the sketch shown the piston has been raised through about 1/11th of the stroke, and has sucked in the amount of charge, and on the point of being ignited by the flame at the side by slide L. The piston being raised through this space by the lever DHN, operated by an eccentric EH, on the shaft E ; the end of the lever DN, whose fulcrum is at D, works on a tappet at N, attached to the rack R, and thus leaves the piston and rack free to ascend after the explosion and during the expansion. It is stated that the mean effective pressure obtained during the downward stroke for use on power is about 7 lbs. per square inch, and that they were made up to 3 B.H.P.

They, however, showed a great economy in fuel, as compared with anything that was at work in those days, and in the author's opinion much more will be done in the immediate future by adopting a means in which the lower end of the expansion diagram may be utilized for the production of power, thus increasing the actual efficiency of all internal combustion engines. Whether this will be accomplished by means of compounding, as in steam engines, or by the lengthening of stroke, etc., remains to be seen, but the matter is worth the consideration of engineers and designers, as greater commercial results may yet be got from the gasification of fuel, whether it be coal or oil. I would here like to point out what to my mind appears to be very misleading to the average engineer. Internal combustion engines are described as either oil or gas engines. Both are gas engines, the only difference being that gas is made in one instance (in the usually-termed " gas " engine) externally, while the so-called " oil " engine makes its gas, generally, internally. It would be much better if all were termed gas engines, stating whether coal gas, or oil gas, or otherwise.

As might be expected, the scientific French were soon endeavouring to produce an engine that would be more efficient as compared with those using fuel consumption, and the above type of internal combustion engine was soon to be outdone, like that of Lenoir, by engines arranged so that the explosive mixture was compressed before ignition, which showed a still further advance. It was in 1862 that the French scientist, Beau de Rochas, patented an internal combustion engine, the principles of which have formed the basis for designers of this class of engine ever since. The conditions laid down in the patent, upon which it was stated that the success of the engine relied, were as follows :—

(1) Maximum cylinder capacity, with a minimum of circumferential surface ;
(2) High piston speed ;
(3) Greatest possible compression ;
(4) Maximum pressure at the commencement of the power stroke.

He first pointed out the advantages of compressing the explosive mixture before ignition, in order to get a higher temperature and consequent greater expansion, and he proposed to have four operations take place, and during two revolutions of the engine, to have four strokes, which are shown in Figure 6.

During the first out-stroke from A to B, a charge of air and gas is drawn into the cylinder through inlet valve I, from B to C, the first in-stroke. The charge is compressed ; at about point C the compressed charge is ignited, causing a rapid rise in pressure (as in the gun, Figure 1), which causes the piston to make its second out-stroke (power-stroke) from C to D. During the second in-stroke from D to E, the exhaust valve X is held up, so that the products of combustion are thus expelled to atmosphere, thus completing the cycle. Figure 7 shows the operation of this cycle, which is often mis-called the Otto cycle, chiefly because an ingenious German engineer, Dr. N. A. Otto, was the first to make practical use of it in an engine so constructed. The whole credit of this epoch-making invention, however, is certainly due to the ingenuity of the enlightened Frenchman.

To avoid infringing the patent rights which covered this cycle, many attempts were made to construct internal combustion engines working on a different cycle, and of these that patented in this country by Mr. Dugald Clerk in 1880 was one of the most successful. A separate pump was employed to force the charge of air and gas into the cylinder at the termination of the expansion of the power stroke. This charge was compressed by the in-stroke and ignited in the usual manner, and thus a power stroke was obtained once in every revolution of the crank shaft.

The majority of internal combustion engines to-day work on the beforementioned four-cycle principle, but there is yet another cycle that has made advances, especially in small powers such as are required for launches and small cargo boats, and a very large number of these engines are at work, doing good service in many directions, although their heat efficiency is not near that obtained by means of the four-cycle engine. Yet they are very interesting machines, insomuch that they embody what is almost as valuable, simplicity of construction, in fact it would be indeed a very difficult matter to design a prime mover that embodied less working parts, and consequently requiring the minimum of attention. The cycle referred to is what is known as the two-cycle principle, in which the four essential operations, namely, charging, compression, firing and exhaust, are performed in one revolution of the fly-wheel instead of two, as required in the previous cycle. Figure 8 shows this engine in diagram, showing the in-stroke of the piston, It will be seen that a mixture of gas and air is drawn in at A, from the carburetter or mixer, to the crank case B. A previous charge is being compressed in the combustion chamber D. Just as the crank is turning the top centre it will be observed that the electric spark is igniting the charge. The pressure so raised will push the piston forward, and expansion thus takes place, until the exhaust port F is uncovered by the piston (which forms its own valve), the exhaust gases then escaping under the remaining pressure into the exhaust pipe or box, the pressure in the cylinder being also at the same time reduced. It will also be understood that the charge drawn into the crank chamber is also being compressed by the downward movement of the piston, ready for the inlet port C to be uncovered by the piston. The mixture, being under slight pressure by means of the descending piston, immediately escapes into the combustion chamber, and by means of deflecting plate is guided up to the top of the chamber behind the still escaping low-pressure exhaust gases, but before the new gases have time to escape after the exhaust gases the piston is on the return and the inlet port closed, and immediately after the exhaust port is closed likewise, so that the thus imprisoned live gases are compressed and the cycle reperformed. There is no doubt that a reduction in the weight of a given engine can be brought about by this cycle, but it is, in the author's

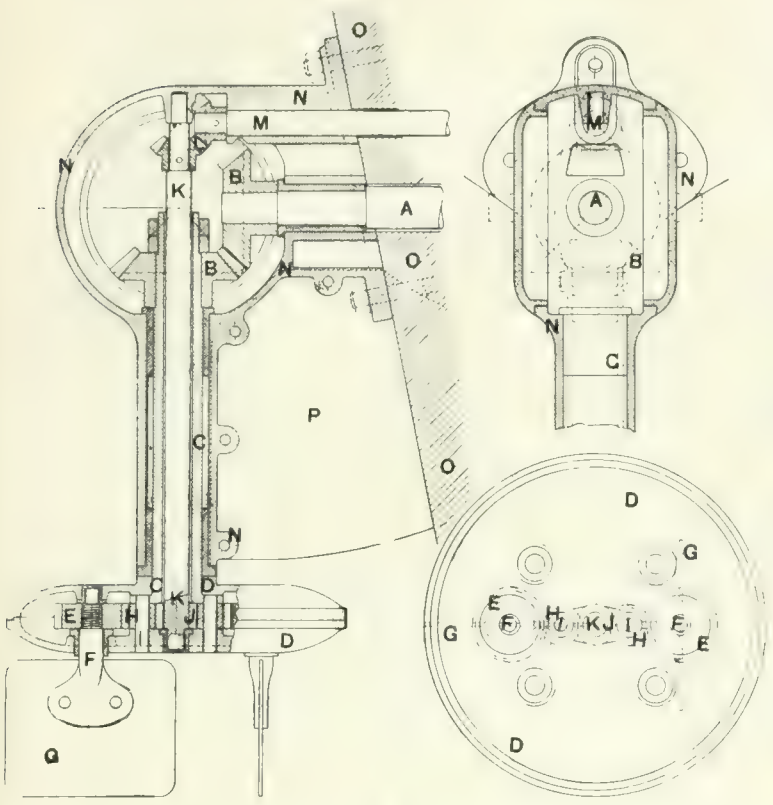
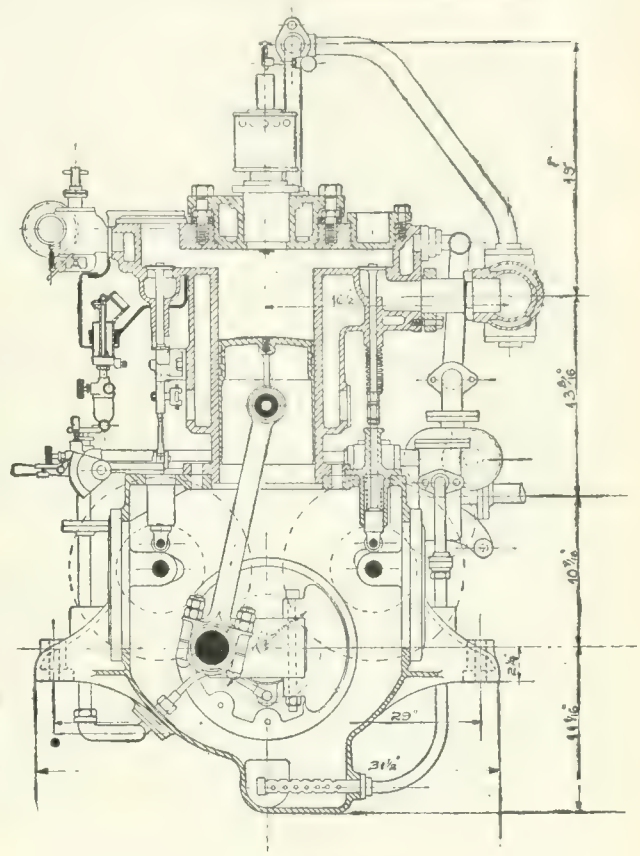
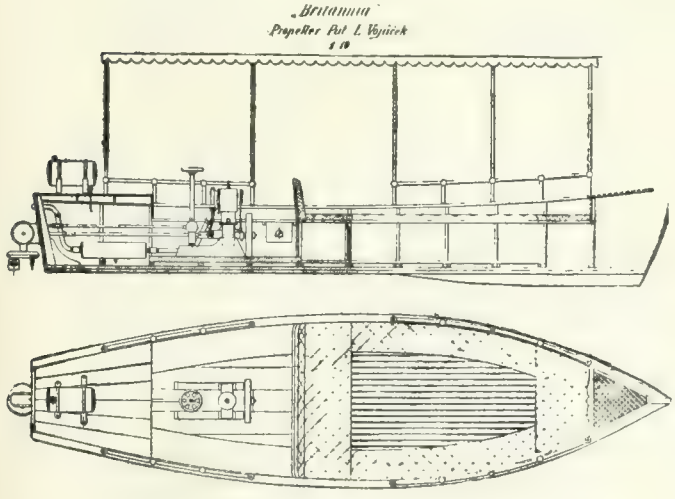


Fig. 16.

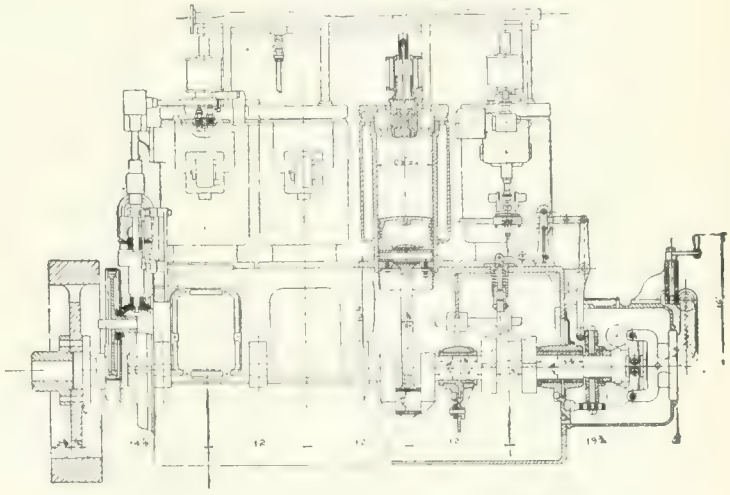


End section of drawing of Messrs. Norris & Henty's Marine In Combustion Engine.

opinion, only suitable for small powers. There is no question, however, as to its reliable working in such. Giving an impulse at every revolution it certainly is the ideal engine for the propulsion of small powered boats, and especially where simplicity is really required. As is well known this engine has no valves, so to speak, or tappet rods, cam-shafts, springs, etc. Figs. 9 and 10 show a 20-B.H.P. two-cylinder engine of this cycle in detail. It will readily be seen that for this engine there are only five working parts, namely, crank-shaft, two connecting rods, and two pistons. As I previously stated, it would be difficult to construct an engine with fewer working parts, and there is no doubt that its simplicity is the reason why it is largely used, although its fuel economy does not approach that of the four-cycle engine for the previously mentioned reasons. They are reasonably quiet as compared with equal four-cycle engines, owing to the absence of valve gear, etc., and also to the fact that there is a practically constant downward pressure on the head of the pistons, instead of the alternating pressure, and suction on the piston heads of the four-cycle engine, which no doubt tells on the bearings, etc.



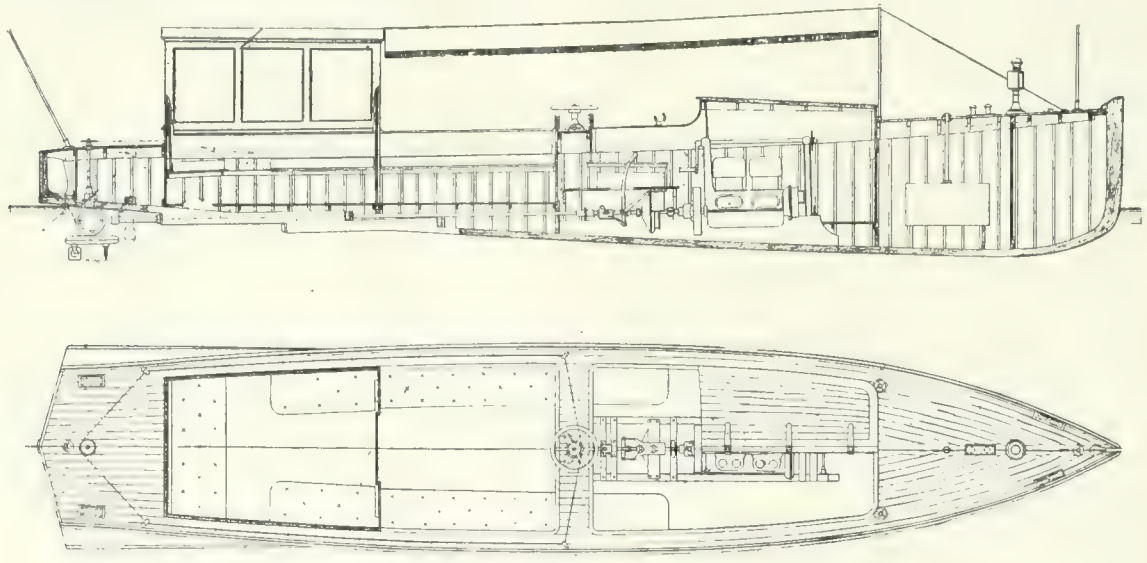
The *Britannia*.
Fitted with the "Paragon" Marine Propeller. No rudder required, and non-reversing engines.



Side view and section of Messrs. Norris & Henty's Marine Internal Combustion Engine.

The consequence is that the two-cycle engine has found a number of admirers, especially where the cylinders are off-set from the centre line of the crank-shaft, the consequent wear is then very slight, and they have a good life, and in the engine shown of which the author has had good experience, a novel feature is that the cool incoming mixture through the channels of the piston keeps the piston from overheating, and reduces the carbonizing of lubricating oil to a minimum. The arrangement of the distribution is such that the heat is not localized, so that the cylinder and the pistons are of more equal temperature; expansion and contraction are, therefore, at a minimum, with little distortion of either. There are, however, some very difficult things to be observed and guarded against in the application of the two-stroke engine for marine and other work in which the engines have to work in confined and possibly inaccessible places, especially when petrol is used as fuel. Some engines give quite a lot of real trouble through what are termed crank chamber fires, which are caused by the charge in the crank chamber being ignited by the still burning charge in the combustion chamber. The remedy for this is to reduce the speed of the engine, or to increase the speed of combustion, by means of a weaker mixture. The faults, however, generally are to be traced in the design of the engine; the most successful and reliable are those engines that have a large area exhaust port, compared with steam engines), and other means must be employed to overcome this objection, such as the use of compressed air, or forming an explosive mixture in the combustion chamber when set on the out-stroke, which methods are not the most reliable or ideal. Such engines are, consequently, not reversing in the true sense of the word, and other means, such as reverse gear or a complicated system of cam alteration and timing, is necessary, which raises the cost and increases the wear and tear and also takes away the very object of the cycle in the way of simplicity, which is essential.

As will be seen by reference to the diagram in Fig. 7, such engines produce great noise, owing to the pressure at exhaust above atmosphere, which, as above stated, is a loss of power. This should if possible be avoided, and must be if the engine is to have the maximum of efficiency. Further, these engines are liable to produce a certain amount of objectionable smoke, and smell, faults which must be considered when attempting to apply them to such vessels as ocean-going passenger boats. At the same time, unless complete combustion is obtained the highest thermal efficiency will not be obtained, which is desired from many aspects commercially. All the above faults are due to the thermo-dynamic principles involved in the engine itself, and it is impossible to avoid them without the use of, say, starting handles, or other means



A powerful high-speed motor boat fitted with the "Paragon" Marine Propeller, now under trials in the Mediterranean.

or several, so that the speed of the incoming charge can never catch up the exhaust. The engine shown in Figs. 11 and 12 is especially designed from great practical experience, in order to avoid these little matters which may be observed, are of vital importance in various ways, especially in sea-going boats. However, there are many engines of such design that give no trouble in that direction, and in fact the *Britannia*, the small boat shown later, is fitted with one of this type engine, and has never given the least trouble. At the same time it is as well to have means on any two-stroke engine to provide that the revolution speed cannot be excessive.

With the exception of perhaps the Lenoir engine all the above engines were constructed on the principles of explosion similar to that in the case of the gun shown in Fig. 1. Although very efficient as compared with what can be done with other methods of power production, such as with the application of steam, they have, however, drawbacks that even to-day have not been eliminated, although many designers are at work endeavouring to do so. The ordinary four-cycle explosion engine is in many ways difficult to apply, for instance, to marine propulsion, or other applications in which certain essential requirements have to be considered. These faults are, for instance, inflexibility, as to run these engines really efficiently the revolutions must be kept about constant or otherwise, owing to atmospheric conditions being dominant, indifferent mixture will result in possible heat and other losses. These engines are not self-starting (as of starting or giving the first necessary movement to the piston, etc. If a change of speed is required on the driven work, it is essential to put in some sort of change speed gear, and if silence is required it must embody a suitable exhaust or further expansion box, and all the time that such types of engines are used the above parts are absolutely necessary. Further, the admission of gas being constant it is not possible with economy to vary the torque on the crank-shaft to any great extent, and even then by such methods as gas variation or alteration of the ignition points which will be shown later are wasteful, and not ideal methods. Owing to the explosion principles being used in such engines, the compression before ignition is limited, and for that reason the clearance between the piston head and the cylinder head must be large, in proportion to the total volume of the sweep of the piston in cylinder. This clearance is in some engines as much as 20 per cent. of the total volume, and for that reason alone brings about enormous losses in the possible thermo-efficiency in the engine itself, and is a question that should receive the very closest attention by all designers of engines, especially those who are working on a possible marine engine, as the weight must be considered, and it is the author's opinion, which he has already expressed at the meetings of this Institute, that the future marine engine must be designed on the principles that are involved in the gun as shown in Fig. 2, that is on the lines of constant pressure combustion, thus reducing the initial pressure, and increasing the length of expansion.

The idea of securing combustion in an internal combustion engine at constant pressure instead of constant volume (as in the previous engines) during the period of combustion is not a new idea, for as far back as 1873 Brayton, in Philadelphia, U.S.A., brought out his well-remembered cycle and engine, in which the gas and air were compressed in a separate cylinder and burnt in the working cylinder. In 1878 Messrs. Simon, of Nottingham, acquired the Brayton patents and brought out this type of engine with a miniature steam boiler over the combustion chamber. The steam thus generated was blown into the combustion chamber, and although some very interesting experiments were made, this engine was stated to have not been successful. Messrs. Hennig and Co., in Germany, about this time, brought out the Brayton or Simon engine with many mechanical improvements. Foulis, of Glasgow, in 1878, patented an engine similar to that of Simon, and in 1881 brought it out in improved form, and what is also interesting is the fact that he utilized the heat from the exhaust gases for raising the temperature of the incoming gases, as well as the separate compression principles and constant pressure combustion.

In theory all these engines proved very attractive propositions, but as the mechanical (in those days) difficulties multiplied for the small sizes that were required in those earlier days, the truth is that the simple Rochas, or Otto, type of engine was pushed with such a success that designers were not encouraged, so that no doubt the constant pressure combustion type of engine was neglected, in favour of the engines which have compression, ignition and expansion in a single cylinder. In the small type that were then in the majority of cases required, this gave a simplicity with which the small type constant pressure combustion engine could not compete, and therefore they were abandoned.

They have been revived from time to time by various experimenters, but in spite of the great possibilities shown by theory they have until the last few years found little demand of importance, with the exception of the Diesel type of engine, which is based on the principles laid down by both Rochas and Brayton. The author believes that now the question of large power is being suggested for the propulsion of vessels of large tonnage, designers and manufacturers will be driven to take the matter up with a seriousness never before thought of, and that the obstacles that lie in the way of successful construction will, with modern engineering practice and metals, be overcome, also that the constant pressure combustion engine will be in general use before many years, not only for use with gas made from oil, but also that made from coal or other fuel.

By referring to Fig. 2 it will be observed that the designers of guns have seen the advantages of the constant pressure method of combustion. Here, as will be seen, the advantage of the burning time of powder has been made use of, and it will be seen that the projectile has travelled some distance before the maximum pressure or the completion of the burning period has taken place. The pressure, it will be observed, has not risen above 17 tons per square inch, and as the charge is larger and longer, the expansion is extended, resulting in an increased velocity being given to the projectile, and no doubt less recoil, as compared with the gun shown in Fig. 1. Here, again, is an analogy and a matter which go to show that with the constant pressure combustion engine less strains are set up and more equal turning moment obtained. So far this matter has received, as far as the author is aware, very little attention by those advocating internal combustion engines for main propulsion; it is, however, one of very serious moment, and no doubt will be receiving close attention by designers. The multi-cylinder engine would appear to somewhat reduce the strains, but it is a matter that, however, will have to be taken into account when coming up to very large powers. The author's opinion is that as the efficiency of engines of modern power and those of larger power do not alter materially as the power goes up, to overcome the difficulty the most suitable way is to split the total power of the prime-movers up in various units, and by some connecting medium such as electrical power transmission bring it about that, say, several engines may concentrate their power into one powerful electric motor driving the propeller shaft; a view that is also held by our highest authority in naval engineering, and many others that have given this application of the internal combustion engine technical consideration. It will be shown later how such arrangement will facilitate economy all round.

Figs. 11 and 12 show side and end sections of the Diesel engine, and it should not be forgotten that nearly every writer on the thermo-dynamic principles of heat engines has drawn attention to the Brayton type of engine, and its greater scope for higher thermo-dynamic efficiency, and have lamented the neglect of this cycle by our leading designers and builders of internal combustion engines. It is, therefore, to the great credit of Dr. Rudolph Diesel, who set to work and brought out the famous cycle under his name, which engines are now meeting with such a large and successful demand in all parts of the world. There is no question that in large or small sizes it is the finest prime-mover that we have, and by a study it will be seen that the laws that Rochas and Brayton laid down have been carefully considered by him, as regards high compression and constant temperature, pressure and combustion. Fig. 13 shows a normal curve taken from one of his engines, and Fig. 14 shows the action of the governor fitted to the engine, which varies the point of cut-off very similarly to that of a steam engine.

Dr. Diesel has been good enough to forward especially for this paper also a very interesting sectional drawing, shown in Fig. 15, of his very latest quick-speed engine using crude oil.

As will be seen it is entirely a new design for Diesel engines, and is especially brought out to meet the demand for small-powered engines such as are required for say driving auxiliary machines, or for the propulsion of small boats, etc. A test made on one of these engines is interesting and is as follows :—

Loading Trial for small latest type "Diesel" engine.

Rating delivered.	½ Load.	¾ Load	Normal Load.	Over load Normal speed.	Over-load at higher speed.
Duration of Test, Mins.	28·5	35·2	40·49	31	8·29
Average Speed	620·3	610·4	609	603·8	828
Indicated H.P.	6·20	7·24	8·17	9·66	13·20
Brake H.P.	2·61	3·83	4·70	5·58	7·65
Fuel required per H.P. hour in Kilograms	0·315	0·262	0·248	0·273	0·284
Cooling water per hour in Kilograms	24·2	19·3	18·0	36·0	21·5

The above shows remarkably good results for so small an engine, and the test was carried out by Professor Romberg at the King's Technical High School at Berlin quite recently. The engine can be made at the present time up to 30 B.H.P., in which case there are six cylinders, and the weight is not more than 80 lbs. per B.H.P., which includes a bedplate (not shown), air vessel, oil vessel, and exhaust pipe, etc., which is about 1/10th of the weight of the original stationary Diesel engines of the same rating, but the above sketch shows how the engine would appear for fitting into small passenger and cargo boats. The exhaust is colourless, and without fumes, and the revolution speed can be arranged from 600 to 200 r.p.m., or same can be accelerated in such cases as in racing boats for short periods up to 1,000 r.p.m. The machine, however, is somewhat different from the usual design of Diesel engine, and I understand that Dr. Diesel in the near future intends to develop an engine that will be suitable for larger powers. He states also that it will be very suitable for use in connection with the Paragon electrical propulsion scheme, in which he has taken an interest, both in its application to marine engineering, and also in another sphere of transport, *i.e.*, that of main line railway traction, to which, in conjunction with such efficient internal combustion engines, the author intends to shortly apply same.

In connection with the above and other high-speed engines, an interesting advance in propeller design has been recently brought out and patented in this and other countries. Figure 16 shows this propeller; as will be seen it is constructed on the feathering paddle design and has some very novel details about it. For instance, the full power reverse can be given under control from the steering wheel, with the

least exertion, and the ahead speed, or the steering of the vessel can be carried out by the direct power of the prime-mover, and without the necessity of altering the torque or direction of speed of the engine. It is in the author's view a great advance in the most troublesome matter of propeller design for propulsion. Referring to Figure 16 a description will be of interest :—A is the power shaft from the engine or turbine, as may be desired ; B, equal drive bevel wheels driving vertical revolving power sleeve ; C, the above power sleeve coupled to the revolving small case ; D, revolving power case, containing feathering small gear wheels ; E, two small gears, only carrying the small power for feathering the blades ; F, short shaft taking the power from the revolving case D ; G, propeller blades, generally two, renewal a very easy matter ; H, two intermediate connecting wheels ; all these small gears are running below water line and in grease, absolutely quiet and lasting ; I, fixed spindle on which run the loose intermediate wheels H ; J is a centre pinion that is usually in a stationary condition ; by its means, however, the degree of feathering is adjusted, which decides if the re-action from the propeller shall be ahead or astern, or partly so ; this position is controlled by means of the steering wheel ; K is the small vertical shaft that is attached to the angle bevels above, leading to the steering wheel shaft ; L are the above bevels ; M is the horizontal shaft leading to the steering wheel, by which means full control is brought about ; N is the stationary case taking the whole propeller, which from the present design will be seen, and the importance of requiring no usual thrust block, this case is bolted direct on to the stern-post shown ; O is the stern-post, and it will be seen that only two small holes are necessary for the application of the propeller to existing boats, etc. ; P is a steel plate that takes a part of the direct thrust of the propeller, and also forms a steadying piece.

The above propeller has been tried on various types of vessels with greatly improved results, as compared with what is possible with the ordinary screw type of propeller, and in some cases as much as 30% more effective thrust per shaft horse-power at given revolutions has been demonstrated and accepted by some of the highest authorities on the Continent. I will, however, not dwell here on its effect on the application of the internal combustion engine for marine propulsion, and all the difficulties that can be got over by its use, which are obvious ; rather will I rely on advantage being taken of inspecting and testing the small vessel that is now running on the Thames so fitted, in which will be noticed the easy and quick steering, stopping and turning on its own centre and many other details that are essential before it can be claimed that we have the maximum of manœuvring power, applying with equal effect, not only to vessels on the surface, but also to those called submarines, in which the ideal of automatic stability can be brought about.

Well, Gentlemen, this subject which I have endeavoured to place before you in as lucid a manner as I am able, involves an immense number of points. It has been felt that the details are of such a complex character that it will be better to divide this paper into two sections, the second of which I propose to read to you at the meeting arranged for by our Secretary, on the 28th of November next. Whether my paper is altogether equal to the subject and whether my contentions appeal to you as convincing or not, I sincerely hope that the facts I am placing before you will lead to the further development of this important subject, possibly on the lines that are and will be indicated, and that some further real progress will be made in the evolution of the internal combustion engine.

The reader is referred to the following excellent works, to which the author expresses himself indebted for some assistance in the preparation of this paper. Goodeve's "Text Book of The Steam Engine." T. Hyler White's "Petrol Motors and Motor Cars," and Homan's "Self-Propelled Vehicles."

Mr. Walter H. Derriman, B.Sc., A.C.G.I., A.I.E.E., Fellow of the Chartered Institute of Patent Agents, has entered into partnership with Messrs. Dicker & Pollak, chartered patent agents, of 37, Furnival Street, Holborn, E.C., and in consequence the name of the firm has been changed to Dicker, Pollak & Derriman.

Institute of Marine Engineers. We understand that the "Fuel Test" arranged for October 3rd will not take place and that instead a demonstration will be given of Mr. Edwin Tate's Stability Indicator.

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

The "Mauretania" and the "West Point."

ONCE more has public attention been called, somewhat sensationally perhaps, but nevertheless most effectively, to the immense importance of wireless telegraphy at sea. Sixteen lives have certainly been saved in this one instance from a terrible ending. The Liverpool steamship *West Point* sailed from Glasgow for Boston, with a cargo comprising, amongst other things, oil, grease and wool, on the 18th August. Suddenly at 6.30 a.m. on the 27th August, when some six hundred miles east of Cape Race, fire broke out in the engine-room. How it originated may be disclosed at the inquiry. But at all events it seems to have spread so rapidly that the men were driven out of the engine-room almost immediately, and the heat was so intense that it was impossible to use the steam pumps to fight the conflagration. With such a cargo as we have mentioned, and so fierce a fire in the machinery department, it was at once apparent that the ship was doomed and steps were at once taken to get out two boats. They could not, however, be provisioned because of the violence of the flames, and some thirty hours after the outbreak the position became untenable and the ship was abandoned. The boats nevertheless lay near her till the next day in the hope that as the fire burnt itself out something in the way of provisions might be attainable. This hope, however, seems to have been disappointed. At six p.m. the same evening—that of the 29th August—the ship foundered, and it became necessary for the shipwrecked mariners to look out for some passing vessel. The two boats naturally resolved to stick together, and headed to the northward in order to get into the track of the transatlantic steamships. They encountered bad weather and found some difficulty in keeping on the track. Finally, on the night of the 31st August the boats became separated, and never sighted one another again. One boat, that in charge of the first mate, was picked up by the Leyland steamship *Devonian* bound for Boston. The report given by the rescued men as to the probable fate of the other lifeboat which contained the master, second officer and two engineers, besides other members of the crew, was anything but hopeful, and indeed, had it not been for the invention of Signor Marconi, there is little likelihood that these men had been saved. But the *Devonian* at once sent off messages telling of the disaster to the *West Point* ; of the safety of one half of the crew, and of the probable position in which the other boat might be sought. Eastward-bound the *Mauretania* caught the *Devonian's* instructions, and those on the look-out on the big ship were at once on the *qui vive* for a boat's sail. So at 10.30 p.m. when they sighted signal rockets they knew they had found what they sought. It was blowing hard and the sea was heavy. But the big ship was manœuvred so as to give the lifeboat a lee, and after thirty-eight minutes stoppage the record-breaker was once again reeling off the miles that separated her from England. Meanwhile the rescued, some of whom were in rather a pitiable plight, were being carefully tended and the news of their safety was communicated to both continents. It needs little imagination to sympathize with the feelings of Captain Pinkham and his companions, who—foodless and drenched, in a practically hopeless condition (for they had resolved that their only chance of safety lay in an attempt to sail down to the Azores) —suddenly saw the lights of the *Mauretania* flashing like those of a city over the waves, and wondered whether or no signals would be observed. The chance meant life or death to them and they assuredly knew it. The incident is one which should certainly make for the extension of wireless telegraphy in all ocean-going vessels, even if Sir Edward Sassoon's bill to make such installations compulsory should be withdrawn for the present.

Wireless, too, played its part in the rescue of the survivors of the car-ferry steamer *Pere Marquette* No. 18 which, when crossing from Luddington to Milwaukee, with a load of some thirty freight cars, sprang a leak and foundered on Lake Michigan. The leak seems to have been serious from the first, and an attempt to save the ship was made by the jettison of some nine cars with their loads. Meanwhile the

wireless operator was calling for help, and a sister ship soon came up to the rescue. The distressed vessel, however, foundered most unexpectedly, owing to the bursting of a bulkhead, and considerable loss of life has to be deplored. It will be well if the true circumstances regarding this disaster are noted, as it is quite possible that the story of the loss of the car-ferry boat will be used as a proof of the danger of car-ferries by those who are so strenuously opposing the institution of the ferry between Dover and Calais. It is, however, obvious that the vessel of which we have spoken foundered from causes which had nothing whatever to do with the fact that she happened to be a vessel of this type. Vessels of ordinary types are by no means free from the risk of springing leaks, especially in such heavy weather as seems to have prevailed when the *Pere Marquette No.* 18 went down.

The Atlantic Record.

On the next outward run following the rescue to which I have already referred, the *Mauretania* distinguished herself in another direction, by knocking ten minutes off her own record over the short course and so reducing the time of the Atlantic passage to four days, ten hours and forty-one minutes. It should be recorded, however, that the distance steamed on the present occasion is 2780 miles as against 2784 miles on the earlier passage, so that the increase in speed is not so great as it would appear. On both occasions the best day's steaming was 661 miles, but the worst was 542 miles last year, whilst the worst this time is two miles better. This is another proof, if that were needed, that as ships get settled down and understood the regularity of their steaming becomes more marked.

Another Good Passage

must be credited to the *Kaiser Wilhelm der Grosse*—oldest of the express steamers now on the Nord-Deutscher Lloyd service. This vessel has been about fourteen years at work, yet she managed to beat the Hamburg-American *Deutschland*, sailing the same day from Southampton, by nearly half a day, although I believe she develops something like 9000 less horse-power. The *Kaiser's* special train on this occasion left Waterloo at 9.28 a.m. on Wednesday, the 31st August, and the steamer sailed at 11.40 a.m. She was off Fire Island at 3 a.m. the following Tuesday and docked at 4.48 a.m. The noticeable points in the performance are that the steamer was got away so smartly from Southampton, and that on her voyage she averaged as much as 22·18 knots for the whole voyage.

The Dominion Line.

Messrs. T. W. Ward & Co., of Sheffield, the well-known ship breakers, have just purchased the old Dominion liner *Vancouver* which has been lying for a long time in the Wallasey Dock at Birkenhead. She was built in 1884 by Messrs. Charles Connell & Co., of Glasgow, and is interesting from the fact that she is the younger sister of the now forgotten *City of Chicago* of the Inman Line—a vessel long ago wrecked on the Irish coast. One of the numerous disasters which dogged the career of the old Inman line—probably I think, the loss by collision of the *City of Brussels*—had just occurred and the Inman people were short of tonnage to carry on their New York service. The Dominion Line had just ordered a vessel which they intended to call *Vancouver* from Messrs. Connell, and then she was transferred to the New York trade and named *City of Chicago*, whilst a new vessel was laid down and launched as the *Vancouver*. A single-screw vessel of not much over 5000 tons gross register she has long been hopelessly obsolete for the rapidly improving Canadian trade, though when she first came out she was probably the crack ship on the station. An early event in her career was the sweeping of her decks in the Atlantic whereby her chart-house was carried bodily overboard. Those in the house were never seen again, and—I am speaking from memory, as I am away from my notes—the lost included her master, Captain Lindley. At a later period she sustained heavy damage to her bows in the St. Lawrence. At the close of the Russo-Japanese war she was taken up by the Japanese as a transport for the repatriation of prisoners. Since then she has done little.

It is curious to note that though the Atlantic Combine is an American organization, and that though Mr. Morgan's countrymen never tire of disparaging Englishmen for their want of progress in not scrapping worn-out or obsolete machinery, the Dominion Line—one of the Combine's important limbs—stuck to the *Vancouver* for some time after her career was finished, and still has in the same Wallasey Dock where she was laid up two other old ships. One of them is the *Ottoman*, and the other the *Ottawa*. The latter is no less than thirty-six years old, having been launched as the mail steamer *Germanic* for the White Star Line in 1874, and having in her day held the blue riband of the Atlantic.

The P. & O. Company

has availed itself of the opportunity afforded it by the acquisition of the Blue Funnel Line to issue a new series of round-the-world return tickets, giving its customers the opportunity of travelling in one direction to Australia *via* the Suez Canal and of returning by the Cape. It has also now a circular ticket by which facilities are given for the voyage by steamer to Japan—with opportunities on slight extra payment for stopping over *en route*—and back overland by Siberia. Its parcel service to the countries served by its various lines of steamships has also of late been much improved and consolidated.

The Union Castle Line.

On the 14th September the twin-screw steamship *Guelph* left Southampton for East Africa *via* Marseilles, Naples and Suez, thus opening the new route of which I spoke last month. She will be followed in due course by other vessels of her class. It should be noted that the vessels detailed for this service are being fitted with wireless, as indeed are the Company's ships employed in their ordinary trade. Both as regards her cargo engagements and her passenger lists the managers seem pleased with the support given to this pioneer sailing.

The *Balmoral Castle*, which is to take the Duke and Duchess of Connaught to South Africa early next month, has now been fitted out for this special service. The naval ratings by which she is to be manned joined her at Southampton on the 19th September.

Seamen and Unused Food.

The *Ruahine* case, to which I referred last month, has now been before a jury who, after hearing some of the evidence, stopped the case against the defendant. They were very properly of opinion that the men took the food in respect of which they were accused of theft, with perfect *bona fides*. That being so, no criminal charge could be sustained against them. At the same time the Judge held that they were quite wrong in believing themselves entitled to take the unconsumed food away, and accordingly now the law on the point is made clear, it will not be safe for seamen to remove surplus food in future.

The West India Mails.

The various services to the West Indies seem to be getting into rather an undesirable position. For some time it has been known that the Banana Subsidy of £40,000 a year, which for some years has been paid to the Imperial Direct Line for its fortnightly service between Avonmouth and Kingston, Jamaica, would not be renewed, and the owners have stated publicly that they will have to withdraw the service and lay the ships up.

Now the Royal Mail Steam Packet Company and the Government have got to cross purposes over the main mail line to the Islands, and the Company has given notice to the Government that on the 10th November it will terminate the existing contract whereby the mails are carried to Barbados on a poundage basis. After that date, indeed, the mail steamships of the line will omit their calls at Barbados and Trinidad and will proceed to St. Thomas *via* the Azores. After calling at that island—which, of course, is not a British possession—they will touch at various ports in Central America and then go on to New York. A suggestion has been made that the mails should go in the mail steamer to St. Thomas and there be transhipped to an inter-colonial steamer. But this proposal by no means commends itself to the residents in various British colonies.

A Remarkable Piece of Salvage

has been successfully accomplished in the case of the steamship *Dunbeth*, which was blown ashore at Angra Pequena as long ago as June of the year 1906. Being badly holed and lying on the rocks, the vessel was soon abandoned as a total

loss. Some German salvors, however, came to the conclusion that her position was by no means so hopeless as was commonly supposed, and, having purchased her, they succeeded in floating her, and making temporary repairs which have stood the test of the long voyage to England. The vessel has been taken to the Tyne, where she is to be repaired by Messrs. Swan, Hunter & Wigham Richardson. The *Dunbeth* was built on the Clyde and owned at Glagsow. She is of over 4000 tons gross register and was, I understand, on her maiden trip at the time of her accident.

The Tide of Traffic

is setting strongly westward. On Saturday, 17th September, there sailed from the Mersey the *Lusitania* with 2046 passengers, *Baltic* with 2130, *Laurentic* with 1500, making apparently a total of 5676 passengers which, one would imagine, to be nearly 6000 persons, not, as the no longer infallible *Times* puts it, "nearly 5000 passengers."

NAVAL MATTERS—PAST AND PROSPECTIVE.

(*From our Own Correspondent.*)

Portsmouth Dockyard.

THERE was quite a large number of Royal and distinguished visitors on the occasion of the launch of the battleship *Orion* last month by Lady Winchester. Shortly before the vessel took the water, Princess Henry of Battenberg's yacht, the *Sheila*, steamed into the harbour with Her Royal Highness, the King and Queen of Spain, and several princes and princesses on board. The King and Queen of Spain afterwards visited the Empress Eugenie on board her yacht, the *Thistle*. Rear-Admiral Goni, head of the Chilian Commission in London, also witnessed the launch from the cruiser *Invincible*. The *Orion* has been taken into the large basin, and the work of fixing her side armour is in progress. The increased length of the vessel and her greater displacement, will make the task of docking her somewhat difficult. No. 15 dock is the only one capable of accommodating her, and this has an entrance width of 94 feet at the coping stones, while the *Orion's* breadth is 87 feet. Next year, however, the new floating dock will have been placed in Fountain Lake, and we shall be better prepared for such large vessels. The battleship *Neptune* is now carrying out her steam and gunnery trials, which are to be completed early in October. She is to be out of hand by January, by which time she will have been in hand two years. When commissioned, it is understood that the *Neptune* is to replace the *Dreadnought* as flagship of Admiral Sir William May, the Commander-in-Chief of the Home Fleet, in which case the latter vessel will be taken in hand for a very extensive refit. The report that we are about to build a motor battleship is regarded as a little premature, seeing that no information as to the principal features of the new vessel, which is to be laid down in January, are available. That the vessel will have internal combustion engines is considered extremely unlikely, but, in the course of a few years, there is not the slightest doubt that such engines will be used for large ships. As to repair work, the cruiser *Good Hope* is well forward, and before long the *Drake*, *Argonaut* and *Mercury* and several destroyers will come in for refits. The scout *Foresight* is to complete her refit early in October, when she will be sent to Sheerness to begin duty with the Third Destroyer Flotilla. An accident occurred to a submarine on September 7th, when the *A11*, ran into and sunk a barge while leaving the harbour. Luckily the two men on board the barge were rescued, and no one was injured on either vessel. The submarine was slightly damaged at the bows and put back to Haslar for repairs. The cruiser *Duke of Edinburgh* went ashore on August 13th on Atherfield Ledge, Isle of Wight. Fortunately the weather was fine and the sea calm all the time the vessel was aground, but a few hours after she had been got off a gale sprang up. The court-martial severely reprimanded the captain and the navigating officer and dismissed the latter from his ship. The old battleship *Edinburgh*, which is on the non-effective list, is ordered to be sold. She was built at Pembroke in 1887 at a cost of £ [illegible]. The destroyers *Parramatta* and *Yarra* arrived here and were inspected by the dockyard authorities before leaving for Australia. Sir George Reid, the High Commissioner for Australia, visited the vessels on September 14th, and a few days later they left under convoy of the *Gibraltar*, which is taking relief crews to Sydney.

Devonport Dockyard.

Good progress is being made with the new cruiser *Lion*, which was launched in the first week of August. The side armour is being placed in position, and all the boilers have been fixed in the after-boiler-room, while the boring out for the propeller shafting is well advanced. Between decks the work is being rapidly expedited, and altogether the vessel is making splendid headway. Quite as good progress is being made with the cruiser *Indefatigable*, and it is anticipated that she will be ready for her machinery trials about the end of October. The cruiser *Niobe*, which has been sold to the Government of Canada, was paid off on September 5th, and commissioned next day by Commander W. B. Macdonald for service as a training ship for the Canadian Navy, and she has since left to begin her new duties. The cap ribbons of the crew bear the inscription "H.M.C.S. *Niobe*." The battleship *Commonwealth*, of the Second Division of the Home Fleet, came in at the end of August for defects in her rudder to be dealt with. The battleship *Mars* is undergoing a most extensive refit, which, when completed, will considerably increase her fighting efficiency. Her defensive equipment is being improved by the substitution of new torpedo nets. The destroyer *Kestrel* is also undergoing a refit and having her equipment generally overhauled. Her starboard propeller shaft having been found to be defective, it has been removed and taken to the factory for centring. The *Success*, when with the local destroyer flotilla in the Gare Loch at the end of August, drifted from her moorings on to the shore. She was refloated a few hours later, and very little damage is said to have been done, but she will be docked for examination on her return to this port. The screw sloop *Rinaldo*, which is on service with the Gunnery School, is to be taken in hand for a refit at the beginning of October. Her place is to be taken temporarily by the cruiser *Pelorus*, which is at present employed in connection with the Navigation School at Portsmouth. The cruiser *Amphitrite* is shortly to be relieved in her duties as training ship for stokers by the battleship *Magnificent*, now at the Nore. The *Amphitrite* will, on being relieved, join the Fourth or Special Service Division of the Home Fleet. The old battleship *Howe* is to be sold out of the Service as obsolete and unfit for further duty. She is a vessel of 10,300 tons, and was built at Pembroke twenty-two years ago at a cost of £640,000. For some time past she has been on the non-effective list. The work at the South Yard in connection with the widening and lengthening of No. 4 dock and making a new shallow draught dock is making satisfactory progress. The capacity of the dock for dealing with destroyers will be practically doubled when the alterations are completed. Rear-Admiral Stokes, who, as previously stated, is to succeed Vice-Admiral Cross as Admiral-Superintendent, will take up his duties on October 4th.

Chatham Dockyard.

We had a visit on September 9th from the First Lord of the Admiralty and Rear-Admiral Sir John Jellicoe, the Controller of the Navy, who embarked here in the Admiralty yacht *Enchantress*. The vessel proceeded to Sheerness, anchoring near Port Victoria on the passage down the river to enable Mr. McKenna to view the site suggested for the new floating dock. Despite the size of the dock and the large draught of water, there are several places in the Medway where it can lie without interfering with the traffic. On the way down the First Lord was also able to obtain a view of the various works which are in progress, including the reclamation of a considerable area of marshes and mud banks, the property of the Government. The *Natal*, of the Second Cruiser Squadron, came in for her annual refit during the last week of August, but she will not remain very long. The *Berwick*, of the Fourth Cruiser Squadron, arrived on September 14th, and was taken in hand for the repair of defects which are to be completed for her to leave the Medway on October 10th, to assemble with the other vessels of the squadron for a cruise to South American waters. The

squadron is to leave England on October 13th and return about January 11th. The destroyer *Rother* came in on September 2nd in tow of the *Swale*, her machinery having broken down, and was taken in hand for repair. The cruiser *Thames*, which had been refitting for the last three months, left on September 13th for Harwich to resume duty as sea-going depot ship of Section III. of the submarine flotilla. The cruiser *Intrepid*, which has been fitted for service as a minelayer, has carried out her steam and gun-mounting trials, and will soon be ready for commissioning. For the present, no other vessels are to be similarly fitted. The minelayers are attached to the Third Division of the Home Fleet and organized as a separate division with Captain Heneage, of the *Naiad*, as chief. The *Andromache*, *Iphigenia* and *Intrepid* are told off for the Nore; the *Naiad*, *Latona* and *Thetis* for Portsmouth, and the *Apollo* for Devonport. The salvage and mooring lighter, which is being specially constructed from the designs of Sir Philip Watts, the Director of Naval Construction, to lift submarines of the "*C*" class, was launched at the end of August, and the two tugs, the *Firm* and *Alliance*, which are intended for service at Dover and Sheerness respectively, have also been launched. The launch of the tugs from No. 8 slip has made it possible for preparations to be commenced for laying down our new cruiser. The blocks are being got ready, and the first keel-plate will be laid early in November. Little progress, however, will be made with the vessel up to March, only £53,696 being allowed for her in the Estimates for the present financial year.

Sheerness Dockyard.

It has been announced that the destroyers of the First Flotilla are in future to be allocated to Chatham for docking and refitting instead of to this yard, as are also the destroyers of the Nore Flotilla. The turbine torpedo-boats serving in the Nore Destroyer Flotilla, whose numbers are being increased from twelve to twenty-four by the transfer of boats from Devonport, are to be dealt with by us, as are also the destroyers and torpedo-boats of the Nore Destroyer Division and the submarines of Sections III. and VII. Flotillas. The rearrangement of work does not make any the less for us, there being just about the same number of craft to see to, but there are more torpedo-boats. The turbine torpedo-boats, however, are practically destroyers, and, indeed, were designated coastal destroyers and given names instead of numbers when ordered to be built. There have been several mishaps to vessels belonging to the port recently. On September 3rd the destroyer *Wizard*, while at anchor off the Sunk Lightship, was struck by a torpedo-boat and had a hole made near her engine-room. A target sail was fixed over it, and the breach was filled from the inside by the insertion of cotton waste, etc. The *Wizard* was in no particular danger, but as a precautionary measure the *Zephyr* escorted her here, and she was taken into dry dock for repairs. The same day torpedo-boat No. 068 arrived and was placed in dock for the repair of damage on the port side, nearly amidships, where she had been struck by torpedo-boat No. 067, which was going alongside her the previous day to enable the officers watching the target practice to change boats. The Nore Flotilla was assembled at the time in the North Sea near Felixstowe for the annual torpedo firing. The damage to No. 068 above the water-line was slight, but below the water line there was a zig-zag rent about three feet in depth. The same morning torpedo-boat No. 074 received some damage, and, after being temporarily repaired at Shotley, came on here. The boat is a most unfortunate one. It is only a year since she was nearly cut through in collision with a collier. Torpedo-boat No. 068 was refloated on September 16th, and No. 074 was then taken in hand. The torpedo-gunboat *Hebe*, after being in hand since July 2nd, when she arrived with her stem and bows extensively damaged through a collision in the North Sea, has left for Dundee to begin duties as sea-going depot ship of Section VII. Submarine Flotilla. The damage was made good by September 3rd, but steering gear defects developed and this detained her another fortnight. The refit of the destroyer *Ranger* is to be completed on September 26th, and she will then go to Devonport to begin duties in the flotilla at that port. Mr. McKenna paid his first visit to this yard on September 9th, accompanied by Rear-Admiral Sir John Jellicoe. The First Lord and the Controller, with other officials, landed from the Admiralty yacht *Enchantress* and inspected the docks, and afterwards re-embarked and went on to Dover and Portsmouth. Nothing official has transpired, but it is understood that the visit was for the purpose of enabling the First Lord to inspect the site proposed for the new floating dock in the Medway.

Pembroke Dockyard.

The cruiser *Blanche* has completed her trials. On the first eight hours of the thirty hours' trial she obtained a mean speed of 24·4 knots at 15,000 s.h.p., and during the remaining twenty-two hours 23·33 knots at 11,000 s.h.p. On the full power trial a speed of 25·67 knots was obtained with 19,755 s.h.p. The whole installation of machinery and boilers worked satisfactorily, and the exceptionally small water loss indicated the tightness of the joints of the system. The trials were run during a period of very stormy weather, and the general opinion of those who were on board is that the ship behaved excellently and will prove an admirable sea-boat. The engineer contractors are busy opening up the machinery in readiness for the vessel's twenty-four hours' acceptance trials, which are fixed for October 6th and 7th. Efforts are, however, being made to get her ready a week earlier. The Yarrow water tube boilers of the *Blonde* have all been placed in position, but at the time of writing only two of the turbines have arrived. The unarmoured cruiser *Active*, which has now been in hand two months, is not making such rapid progress as has been usual with previous vessels built at this yard. However, up to the present the requisite material has not been available, but it is anticipated that a more plentiful supply of material will be at hand shortly, when an accelerated rate of progress will be possible. We have two destroyers in hand for refit, the *Avon* and *Foyle*. On September 20th we had a visit from the Lords of the Admiralty, who attended for the purpose of receiving deputations of workmen.

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,, chips ,,	..	9	5	0	to	28	0	0	,,
,, dust ,,	..	9	10	0	to	25	0	0	,,

Purified, milled and ground.

Ceylon, 97% to 99%, f.o.b. London		59	0	0	to	63	0	0	per ton
,, 95% to 97% ,,		40	0	0	to	42	0	0	,,
,, 80% to 81% ,,		30	0	0	to	32	0	0	,,
,, 70% to 71% ,,		27	0	0	to	28	0	0	,,
American large flake, f.o.b. London		45	0	0	to	49	0	0	,,
,, small ,, ,,		35	0	0	to	45	0	0	,,
Joint Compd. per cwt.	..	2	0	0	to	2	12	0	
Paint Paste ,,	..	2	2	0	to	3	5	0	
Paint per gal.	..	0	4	0	to	0	5	3	

Wholesale lists of tinned goods on application.

SUBMARINE SIGNAL COMPANY.—There are now 130 signal stations, either working, or in course of erection, and 621 ships of the mercantile marine have adopted the receiving apparatus of this Company.

ROSSENDALE BELTING CO., LTD., of Manchester, have been awarded a gold medal for their exhibit at the Manchester Industrial Exhibition which is now being held.

MR. F. W. BRIDGES, the organizer of the Naval, Mercantile Marine and Engineering Exhibition held last month at Olympia, informs us that he has decided to organize another exhibition on the same lines, but on a larger scale, and with considerably extended scope, in 1913.

THE ENGINEERS' UNIVERSAL SUPPLY STORES, of 25 and 27, Sumner Street, Southwark, as the name implies, supply many things necessary to the engineer, among which may be mentioned the "Wescot" overalls. We have seen copies of some unsolicited testimonials recently received by The Engineers' Universal Supply Stores, which speak well of the "Wescot" overalls, and show the purchasers to have been quite satisfied. The price charged is moderate, and prompt attention is given to orders.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our Own Correspondent.)

Launching Activity.—Noteworthy activity in the matter of launching ships characterized shipyard operations on the Clyde on August 25th. Messrs. John Brown & Co., Clydebank, sent off the stocks the steamer *Preussen*, built to the order of the Hamburg-America Line for their Eastern trade. She is a single-screw cargo steamer of about 8,000 tons gross, having a deadweight capacity of about 12,000 tons. By the same tide Messrs. Napier & Miller, Old Kilpatrick, launched the twin-screw steamer *Kulambangra* of 2,000 tons gross. From the Greenock yard of the Greenock and Grangemouth Dockyard Co. there was also launched the single-screw steamer *Broompark* of 2,200 tons carrying capacity, built to the order of the Denholm Lines, Greenock. Her machinery will be supplied by Messrs. Dunsmuir & Jackson, Govan Engine Works, Glasgow.

British India Liners.—Messrs. Alex. Stephen & Sons, Linthouse, launched on September 6th the steamer *Abhona*, the first of three twin-screw vessels now building by them for the British India Steam Navigation Co.

Protected Cruisers.—The protected cruiser *Falmouth*, of the improved *Bristol* class, was launched on September 20th from the Naval Construction Works of Messrs. Wm. Beardmore & Co., Dalmuir. She is one of six sister ships, the contracts for which were placed by the British Admiralty late in October last year. She has only been about ten months on the stocks and is the first to be floated of the six sister ships—the *Yarmouth*, building by the London and Glasgow Co., Govan, the *Dartmouth*, by Messrs. Vickers, Sons and Maxim, Barrow, the *Weymouth*, by Messrs. Armstrong, Whitworth & Co., Elswick-on-Tyne, and two others building at Pembroke Dockyard. They are of 5,250 tons displacement, 430 ft. long, 47 ft. beam, and will be propelled by turbines of about 22,000 i.h.p., designed to give a speed of 26 knots. The *Gloucester* is about to finally leave Messrs. Beardmore's basin and go upon her twenty-four hours' acceptance trials, while the Clydebank cruiser *Bristol* is now coaling at Greenock preliminary to entering upon her official steam trials, which will extend over the better part of a fortnight. Extra interest centres in these trials from the fact that instead of being fitted with Parsons turbines driving four propellers the *Bristol* has Brown-Curtis turbines of about the same power driving only twin propellers.

The Commonwealth Destroyers.—The Australian destroyers, *Yarra* and *Paramatta*, after having undergone highly satisfactory trials on the Clyde, were navigated to Portsmouth, and on September 19th left there bound for Sydney, convoyed by another Clyde-built ship, the cruiser *Gibraltar*, by Robt. Napier & Sons. The *Yarra*, whose final trials took place on the Clyde on August 25th, was built by Messrs. Wm. Denny & Bros., Dumbarton, while the sister vessel *Paramatta* is the product of the Fairfield Shipbuilding and Engineering Co. Both vessels more than met the Australian Government's requirements in the vital respects of speed, consumption of fuel and radius of action. A third destroyer, the *Warrego*, was built at Fairfield, and has been shipped in portions to Australia, where she will be put together by Australian workmen, who have taken part in the preparation of the work on the Clyde. The designs for all three destroyers were prepared by Professor Biles, Glasgow, the contracts being taken upon his specifications. The Australian Navy is growing apace. Contracts for battleships are in progress, and contracts are also being taken for two second-class cruisers of the *Bristol* class. If found practicable, a third cruiser will be put together in Australia.

Suction Spiral-Cutter Dredgers.—Dredging clay and other hard material by suction methods, through the agency of spiral cutters working at the mouth of the suction pipes, is only a recent development in dredger building, and the first Simons patent cutter suction hopper dredger of this type constructed for use in the United Kingdom was launched from the works of Messrs. Wm. Simons & Co., Ltd., Renfrew, on September 6th. This vessel, named *St. Lawrence*, is of 2,000 tons hopper capacity, and has been built to the order of the Director of Works of the British Admiralty; she is fitted—in a separate engine-room immediately in front of the hopper compartment—with an independent set of triple-expansion engines for driving the dredging pump, having all necessary and up-to-date auxiliary machinery. Two sets of triple-expansion surface-condensing engines with auxiliary machinery of the most up-to-date character are fitted aft for propelling the vessel at a speed of 10 knots her hour. Steam for propelling and pumping engines, and all machinery throughout the dredger, is supplied by three marine type steel boilers. The dredging pump is of the most massive and powerful description to withstand the shocks which may be sustained when dredging in clay mixed with stones. The suction pipe is carried on a girder led through a well, forward, and of sufficient length to enable dredging to be done at a depth of 65 ft. below water line. The dredger has also been designed for cutting its own flotation. The cutter at the mouth of suction pipe is driven through a line of shafting, fitted on upper side of suction frame, and machine-cut steel gearing actuated by a set of powerful independent compound condensing engines. The *St. Lawrence* left the Clyde, after dredging and steaming trials, on September 16th, and the berth adjacent to the one from which she was launched is occupied by an almost similar cutter suction hopper dredger, building to the order of the Government of the Union of South Africa.

Training Ship Tender.—Messrs. John Reid & Co., shipbuilders, Whiteinch, are the successful tenderers for the construction of a sea-going tender which the Metropolitan Asylums Board are having built for the training ship *Exmouth*. Messrs. Reid's price was £17,964. The vessel is practically to be a steel sailing ship, having auxiliary steam power, and is intended to act as a sea-going tender to the training ship, and afford the lads experience in handling a ship at sea. The *Exmouth*, which was built at Barrow five years ago, to designs by Messrs. Biles, Gray & Co., has proved a great success, the number of boys on board being now up to the full complement of 700. The new tender, which is from the designs of Prof. J. H. Biles, is to be about 750 tons, and will have quarters for 150 boys. She will be rigged as a four-masted schooner, with square sails on the foremast, and her auxiliary power will be in compound steam engines of 300 i.h.p. Her voyages will occasionally last for weeks, and the work done will count as part of the qualifying service for an officer's certificate.

Naval Guns.—Messrs. Wm. Beardmore & Co., Ltd., Parkhead Forge, Glasgow, have received from the Admiralty an order for three 9·2 inch, 50 calibre, naval guns. The firm have now in process of manufacture naval guns of all sizes, from 13½ in. down to 4 in., and they are re-lining some of the older 12-inch and 9·2-inch guns.

Renfrew Boiler Works Extension.—Messrs. Babcock and Wilcox's already extensive works at Renfrew, devoted to the manufacture of patent water-tube boilers for marine and for land purposes, as well as of mechanical stokers and coal-conveying plant, continue to increase in size. The property of the company covers an area of 43 acres, and in order to cope with the extended business they have found it necessary to erect three large additional shops, each 300 ft. long by 60 ft. wide. The shops will be fully equipped with the most modern engineering appliances suitable for the business. Two of them are required for the manufacture of mechanical stokers and coal-handling plant, and the third is needed in connection with the manufacture of the firm's marine boilers, for which the demand is rapidly increasing. Large orders are in hand at present for boilers for battleships and cruisers for the British and Colonial Governments, and for the Italian, Argentine and Brazilian Navies, while several important contracts have been secured recently for boilers for the mercantile marine.

Marine Electric Installations.—Messrs. William C. Martin and Co., electricians, Glasgow, have secured the contract for the new Cunard steamship *Franconia*, now in course of construction by Messrs. Swan, Hunter & Wigham Richardson, Ltd., Wallsend-on-Tyne, as well as for the sister ship *Laconia*, also building in the same yard. The installation in each case comprises about 3,000 electric lights, in addition to electric bells, fans, radiators, motors, telephones, clocks, searchlight and other appliances. Current will be supplied by three compound engines and dynamos, each of 130 k.w. capacity. Other work now being executed by Messrs.

Martin & Co. includes electrical installations for the steamship *Cameronia* of the Anchor Line, the two steamships, *Inventor* and *Explorer*, for the Harrison Line, several of the new steamers recently ordered for the British India Steam Navigation Co., a large passenger liner for Italian owners, and other vessels. The total capacity of the generating plant involved amounts to over 2,000 h.p.

Lifeboat Building.—Messrs. J. M. Lambie & Son, boatbuilders, Greenock, have on hand an order for twenty-seven large lifeboats for three large steamers in course of construction at Belfast. The same firm have also on hand a number of lifeboats for steamers building in the North of England shipyards. Messrs. Robert Rodger & Co., boatbuilders, Greenock, have at present under construction in their yard at James Watt Dock many large teak lifeboats for a new British India Steamship Co. steamer, fifteen lifeboats for a steamer for the Booth Steamship Co., twenty-four for the Holt Line, fifteen lifeboats and four collapsible boats for the Union Castle Line, and thirty lifeboats for Birkenhead shipbuilders.

East of Scotland Yards.—Messrs. Hall, Russell & Co., Aberdeen, launched on September 6th the steamer *Intaba*, the largest steamer ever built at Aberdeen, and the first built there on the Isherwood system, and also the first built on this system to have a Board of Trade passenger certificate.

The Caledon Shipbuilding & Engineering Co., Ltd., Dundee, have now delivered to the London and Edinburgh Shipping Co., Leith, the new steamer *Royal Scot*. On August 31st, although the weather was by no means ideal, speed trials were undergone, and the result was decidedly gratifying, the mean speed attained over the measured mile being about 19 knots.

The Caledon Co. have contracted to build a steamer of 2,000 tons for the Dundee, Perth and London Shipping Co.

Messrs. Ramage & Ferguson, Leith, have received an order from the Union Steamship Co., of New Zealand, for the construction of a cargo steamer with a deadweight carrying capacity of about 2,750 tons, for delivery in about six months.

Mr. John Inglis, LL.D., of Pointhouse Shipyard, is about to present to the Institution of Engineers and Shipbuilders in Scotland a new portrait of William John Macquorn Rankine, first president of the Institution and a former Professor of Civil Engineering and Mechanics in Glasgow University. The portrait has been painted by Mr. Robert Crawford, Glasgow.

TYNESIDE AND WEARSIDE.

(From our Own Correspondent.)

Tyneside.

General.—So far as actual trade conditions are concerned, shipbuilding activity on the Tyne can be considered, at present, to be in a state of coma. The lock-out of the boilermakers has thrown shipbuilding operations into a dislocated state, and although it is being attempted to carry on work as far as possible with apprentices, it is to be sincerely hoped that the Home Office adjustment, which is now being foreshadowed, may be of some useful effect. The general position just before the lock-out was ably summarised by the "*North Mail*," which reported seven berths filled at the Walker yards, six at Wallsend, five at Howden, three at South Shields, two at Willington Quay, and two at Bill Quay. The new mercantile tonnage under construction on the river was reported as about 180,000 tons, and the outlook was given as not encouraging, owing to the fact that most of the tramps now running are either just clearing expenses or making a loss. The situation in the future will, of course, be intensified by the present troubles.

River Tyne Commission.—The River Tyne Commissioners have had before them the consideration of the terms and conditions upon which they would agree to the transfer of the tenancy of Messrs. R. & W. Hawthorn, Leslie & Co., Ltd., of an oil fuel storage establishment at The Lawe, South Shields, to the Admiralty. The latter wish the facilities of the berths to be improved so as to accommodate vessels 460 feet long and be able to supply vessels lying at other parts of the river with oil by means of barges or tank steamers. They also require a long-term lease of the property.

Messrs. W. G. Armstrong, Whitworth & Co., Ltd.—Perhaps the most cheering news of the month is the announcement that Messrs. Armstrong, Whitworth have leased fifty-five acres of land at Walker from the City of Newcastle, and a further block from the Newcastle and Gateshead Gas Company, making a total area of about seventy acres, with a river frontage of about half-a-mile. This land is adjacent to their present equipment works at Walker, and when it is cleared (the cost of which is estimated at £200,000) the new yards will be utilized to build the large warships whose passage down the Tyne has long been a matter of difficulty. A further estimated sum of £300,000 will be spent in making good the river frontage, and when complete the new yards will probably be the most extensive in Europe. This firm is now engaged in completing the battleship *Weymouth* for the Admiralty, while the work for the Brazilian battleship *Rio de Janeiro* is being pushed forward. Among orders recently booked may be mentioned a Clan liner, while the final touches have been given to H.M.S. Cruiser *Newcastle*. The Lord Mayor has made a presentation on behalf of the Corporation of a fine service of plate to this vessel, which has been built in eighteen months.

Messrs. R. & W. Hawthorn, Leslie & Co., Ltd.—This firm has just launched the destroyer *Nereide* (the twenty-fifth built by the firm for the Admiralty), and is now finishing the *Nemesis* and *Nymphe*. It has received Admiralty orders to build other two, to be named the *Jackal* and the *Tigress*. The firm is spending about £50,000 in new erecting shops and boiler yard at St. Peters, together with the machinery rendered necessary by the increased size of engines for the Admiralty. In mercantile marine work two vessels for the Booth Steamship Company, of Liverpool, are being built, and also a 7,400 ton merchant vessel. Turbine machinery for H.M.S. Destroyer *Active* is now being built.

Messrs. Swan, Hunter & Wigham Richardson, Ltd.—The ocean-going destroyer *Hope*, for the British Admiralty, has this month been launched, while the firm has a further Admiralty order for destroyers just placed. The firm is also applying to tender for the construction of the new Canadian fleet, and work is now finishing on the passenger steamer *Bandon* for the City of Cork Steam Packet Co., Ltd.

The Fishing Industry.—Two developments may be noted regarding the fishing industry. A company has been formed at Blyth to carry on an extensive trawling and ice-making industry, under the chairmanship of Lord Ridley. Negotiations are in progress between the Tynemouth Corporation, the Duke of Northumberland, and the War Office regarding land at North Shields, and a scheme of development of the fishing industry is in course of preparation.

Repair Work.—Among recent contracts for repair work may be noticed extensive work upon the *Fairmead* by the Mercantile Dry Docks Co., Ltd., of Jarrow; the repair by Messrs. Smith's Docks Co. of the s.s. *Rondo*, which collided with the pier head at Tyne Dock; and the work by Messrs. John Readhead & Sons, Ltd., of South Shields, on the *Kirriemoor*, which was badly damaged by fire at Sulina.

Wearside.

The prevailing tone is one of depression, Sunderland streets presenting the appearance to which one has become too accustomed, of a promenade of out-of-works. This is the visible sign of the lock-out, which is severely felt in this port.

River Wear Commissioners.—It is contemplated that dredging operations will shortly become necessary in the vicinity of Wreath Quay, and in the meantime Messrs. Macoll & Pollock, of the Wreath Quay Engine Works, are deepening the river near their works.

Messrs. James Laing & Sons, Ltd.—The Deptford firm has this month received an order from a London firm for an emigrant boat of 6,000 tons, steaming at 14 or 15 knots per hour. During the month one of the vessels launched from this yard refused to leave the ways, but was ultimately launched without damage.

Sunderland as a Minor Admiralty Station.—There is a project on foot to make Sunderland one of the sub-stations on the East Coast for Admiralty repair and coaling purposes. The Sunderland Chamber of Commerce appointed Mr. J. Knott, M.P., to approach Mr. McKenna for this purpose, inasmuch as Sunderland is about midway between Rosyth and the Medway, and possessed dry docks, repairing yards

and shops, coal and oil bunkering facilities, etc. This would make it suitable for destroyers, torpedo-boats and submarines.

Messrs. Osbourne, Graham & Co.—It is reported in the local press that this firm has obtained orders for two new boats, one being for the South African coasting trade, while the other is chiefly interesting, as it will be built on a new system of ship construction to the methods of Messrs. A. L. Ayre and Maxwell Ballard, of Newcastle.

Engine-Building on Wearside.—Engine building on Wearside has of late been fairly brisk, and among recent work may be mentioned triple-expansion engines and large steel boilers built by Messrs. Richardsons, Westgarth & Co., for the *Ariosto*; engines and multitubular boilers for the *Fulgent* built by Messrs. Geo. Clark, Ltd.; triple-expansion engines for the Isherwood steamer *Ingleside*, made by Messrs. John Dickinson & Sons, Ltd.; engines built by the North Eastern Marine Engineering Co. for the *Thisbe* and *Gripfast*, etc.

THE TEES AND HARTLEPOOLS.

(From our Own Correspondent.)

Whitby.

Messrs. C. Smailes & Sons have just had launched at Messrs. Doxford's, Sunderland, a cargo boat of about 6,400 tons deadweight and 1,500 I.H.P.

Middlesbrough.

Messrs. Sir Raylton Dixon & Co., Cleveland Dockyard, are very slack on account of the strike. The sister ship to the s.s. *Berwindmoor* should have been launched last week, and it is reported will not be launched for two or three weeks yet. They are reported to be likely to secure the order for a boat for Liverpool owners that is in the market.

Messrs. W. Harkess & Son have booked an order from Messrs. C. H. Rugg & Co. to build a cargo steamer of about 2,500 tons deadweight for Messrs. Ellerman, of Liverpool, and I understand another order for the same shipowners of about 4,000 tons deadweight is in the market, and likely to be secured by Messrs. W. Harkess & Son.

Messrs. Smith's Dry Dock Co. continue to be busy, both in the building and dry dock department, but no new orders are reported as yet, though some are in the market.

Messrs. Richardsons, Westgarth & Co., Ltd., are reported to have secured an order for machinery for a cargo boat building locally, but there is a slight falling off in inquiries.

The s.s. *Bull*, recently owned by Messrs. I. Watson & Co., is reported as sold to W. P. Donaldson, Esq.

Darlington.

Messrs. R. Stephenson & Co. have secured the contract for twelve months to supply locomotives of various types to the Ottoman Government.

The Cleveland Bridge & Engineering Co., Ltd., have amalgamated with the Metropolitan Amalgamated Railway and Wagon Co., of Birmingham, to construct works at Montreal, Canada, under the name of the British Empire Bridge Co., and have appointed Mr. C. F. Dixon as Manager.

Stockton and Thornaby.

Messrs. Craig, Taylor & Co. are busy with work on hand, but nothing new is reported during the month.

Messrs. R. Ropner & Son are now fairly busy, but prices are low and enquiries show a decided falling off since the strike commenced.

Messrs. Blair & Co. are reported to have secured the order to supply the machinery for a cargo steamer to be built locally and are fairly busy with work on hand.

Messrs. Richardson, Duck & Co. expect to book an order in the market, and no doubt the strike has materially influenced the placing of orders. It is announced that an Italian firm are asking for tenders for a cargo steamer.

West Hartlepool.

Messrs. W. Gray & Co. report nothing new during the month, the old yard being slack, but still have a good amount of work on hand, both new and repair.

Messrs. Irvine's Shipbuilding & Dry Dock Co., Harbour Yard, are fairly busy. They have just launched a small cargo steamer for Dutch owners and have had the s.s. *Ribston* in dry dock for extensive repairs.

The Central Marine Engine Works keep busy engining the boats built by Messrs. W. Gray & Co., but they also are slackening off, due to the strike.

Hartlepool.

Messrs. Richardsons, Westgarth & Co. keep fairly busy with work on hand, and their speciality department has recently put an accumulator for land engines on the market, for which they have several orders, also condensing plants, etc.

Messrs. Irvine's Shipbuilding & Dry Dock Co., Middleton Yard, have made a start on the large Clan liner, the sister-ships of which are being built on the Clyde. They are fairly busy, but enquiries have fallen off very much lately.

The s.s. *Ingram*, built by the late firm of Messrs. E. Withy and Co., is reported as sold to foreigners, also the s.s. *Phillip*, belonging to Messrs. Allison & Co.

Messrs. Furness, Withy & Co. have sold the s.s. *Persiana* to Greek owners.

THE HUMBER AND DISTRICT.

(From our Own Correspondent.)

Messrs. Earle's Shipbuilding & Engineering Co., Ltd., are just finishing the s.s. *Bury* for the Great Central Railway Co. to run between Grimsby and the Continent, and have received another order for a sister ship to the *Dewsbury*, *Accrington*, *Blackburn* and s.s. *Bury*. The firm has been fairly busy with repair work, but several of their departments are close upon a standstill, owing to the general lock-out of shipyard employees.

Messrs. Cooper & Co., engineers and boilermakers, have been fairly busy at the Neptune Engine Works with ship repairs, etc., and the moulding department keeps fairly busy with English and foreign orders for propellers. The branch shop situated at Alexandra Dock has had several steamers in during the month for overhauling and machinery and deck repairs.

The North-East Coast Engineering Works have done a large amount of deck and engine-room repairs to the following steamers:—*Skerne*, *Rhodesian*, *Garton*, *Loyal Briton*, *Tees*, *Etton* and *Ben Nevis*.

Messrs. Amos & Smith, engineers and boilermakers, have been successful in securing further orders for boilers and machinery for Grimsby owners, and the firm still continues working night shifts, but should the lock-out continue the overtime will have to cease. The Albert Engine Works are very busy with outdoor work on the ships, and the branch at Alexandra Dock is fairly busy with dry dock propeller work, etc., and has always a fair amount of work to do among the steamers in Alexandra and Victoria Docks.

Messrs. Stewart & Craig, engineers and boilermakers, have had a good month with repairs as follows:—s.s. *Eschelbrook*, new funnel, deck and engine-room repairs; s.s.'s *Dalton*, *Ellaston*, *Eliston*, *Grendon Hall*, *Rocklight*, *Beta*, etc., general repairs. They have also carried out extensive repairs to the sailing ships *Emma Laurans* and *Windsor Park*, and contracted for heavy repairs and dry-docking for several ships due shortly.

Goole Shipbuilding & Repairing Co., Ltd., have three new steamers on stocks building. Unfortunately through the general lock-out both new and repair work is practically at a standstill.

Messrs. Cochrane & Sons, shipbuilders, Selby.—This firm has been successful in booking several orders for new trawlers for Grimsby owners.

Messrs. Woodall & Co., engineers and boilermakers, have been fairly busy during the past month on the following steamers:—S.s. *Sigurd*, new rudder pins and overhauling of steam-steering gear; s.s.'s *Olaf*, *Gran*, *Edda*, *Munice*, general engine-room and deck repairs. They have also completed orders for the London County Council for their patent Handibloc and heavy purchasing gear. The outside staff has been fully employed at the Corporation's tramway department on boilers and machinery.

Hull Central Dry Dock & Engineering Company has been well employed in their own dry dock, and had to engage the Alexandra and Albert Dry Docks. The s.s. *Lisette*, now in the Company's dock, is having extensive repairs to her bottom. The s.s.'s *Heliopolis* and *Hothenfels* are docked in the public docks, the former having a number of plates removed. The s.s. *Don* is having temporary repairs done.

The chairman and directors of this Company have done a wise thing in promoting Mr. R. A. Thomson to be secretary of the Company, he has been with them eighteen years and is a man who commands respect. He is well known among shipowners and superintendent engineers.

Messrs. C. D. Holmes & Co., Ltd., engineers and boilermakers, have had a very busy month in general repairs, etc., and have been successful in booking a few orders for Grimsby and Hull owners. Orders for half a dozen of their compound winches have come in and their branch shop at the Alexandra Dock has been kept fairly busy with deck and engine-room repairs on several large steamers, besides dry-docking.

Coal Shipment at Hull.—An instance of the expeditious manner in which coal shipments are now dealt with in the North-Eastern Docks, Hull, is afforded by the loading of the s.s. *Sir Francis*, owned by the well-known firm of Messrs. Wm. Cory & Sons, Ltd. This vessel was berthed at the No. 4 hoist in Albert Dock at six a.m. on the 3rd Sept. ; after loading 2889 tons of cargo and bunkers she was ready for sea again at 5.55 p.m., the actual loading time being nine hours fifteen minutes, or a rate of 312 tons per hour. This is a striking performance for a vessel of this size.

Hull Branch Marine Engineers' Association.—On the 13th of September a party of over sixty marine engineers of different steamers in the Hull Docks met at the Tramway Power Station, Osborne Street. After inspecting the boiler rooms and all appliances therein, the party proceeded to the engine and dynamo-room, which contains five 500 horse-power generating sets and one 1500 horse-power generator recently erected and capable of supplying current for ninety to 100 cars. The main and distributing switchboards, condensers and motor-driven pumps were also inspected. Proceeding by private car to the Liverpool Street car works the members went over the various departments, *viz.*, car body building, car painting, tyre shops, motors, controllers, armature shop, etc., and witnessed work in progress. Mounting a special car the members went on to Sculcoates Lane Electric Power Station, where they were divided into groups of fifteen each, some going to the boiler-room containing twenty Lancashire boilers, fitted with automatic coal conveying, elevating and stoking arrangements, and using about 16,500 tons of coal per annum. In the machinery and dynamo-room were noted engines, compound and triple, developing 10,000 horse-power, the total normal capacity of generating plant being 6500 kilowatts. High-tension switchboards—by Ferranti, of the backless type—of slate and metal only, with no combustion material. Total length of cables, feeders and distributors, 180 miles. The motors connected are used for driving machinery for a great variety of purposes, from the mammoth crane at Earle's shipyard down to the smallest sewing machine. It may be stated here that it is quite the exception to find any manufacturer or power user who does not use the public electricity supply for one purpose or another. The system of supply is what is known as the high-tension continuous current system, and is reduced down to 220 volts. The total number of consumers attached to the Corporation mains is 3368, of whom 618 are power users—aggregating 7108 horse-power, and the balance lighting consumers with an equivalent lamp connection of 221,901 8-c.p. lamps. The area of supply is approximately twelve square miles. The plant was stated to have cost £365,000. The visitors included Mr. Summerscales (ex-president), Mr. Grace (vice-president), Mr. Milne (junior vice-president), Mr. J. Shepherd, secretary, and Mr. Seymour, late secretary of the Hull branch.

SOUTH OF ENGLAND AND ISLE OF WIGHT.

(*From our Own Correspondent.*)

Messrs. J. Samuel White & Co., East Cowes, I. of W., have handed over to the Admiralty on completion of satisfactory acceptance trials the ocean-going torpedo boat destroyer *Basilisk*. This vessel has been completed and handed over fourteen days within contract time. The *Basilisk* is a sister ship to the *Harpy* of the 1908-9 programme. Satisfactory progress is being made with H.M. destroyers *Redpole*, *Rifleman* and *Ruby*, these vessels being in the 1909-10 programme. The two destroyers recently placed with this firm have been named *Ferret* and *Forester* respectively.

Messrs. Simpson, Strickland & Co., Ltd., Dartmouth, are well employed in all departments. They have recently despatched three sailing cutters for the Brazilian cruiser *Barroso* and a steam cutter for the same vessel was completing at the end of last month. A 50-ft. steam pinnace for the British Admiralty is under construction, and a 43-ft. teak boat for the India Office was launched about the end of September. A 26-ft. boat for the Belgian Government is awaiting delivery and a fast 45-ft. composite launch is nearing completion. She is fitted with four-crank quadruple machinery and an oil fired boiler. Several orders have recently been placed with this firm, including steam boats for the British Admiralty, a 51-ft. steel launch for abroad, a 30-ft. launch for the s.y. *Sagitta*, a 22-ft. launch for the s.y. *Mavis*, and a 32-ft. galvanized steel launch for abroad and four boats for a yacht recently ordered. In addition to the machinery for the above boats, which is being manufactured by the firm, there is a good deal of new and repair work in hand. An order was placed last month for a large water-tube boiler for service abroad.

Messrs. The Parsons Motor Co., Ltd., Town Quay, Southampton, are exceedingly busy, and although this is usually regarded as the off season, the works are running overtime, and this is likely to continue. The firm have in hand 120-h.p. sets for China, combining compressed air starting, and operating on paraffin. A start has been made on a still larger engine of 180 h.p. The reverse gear for these large engines is of the firm's positive type, and there is no clutch or brake band to require adjustment. A six-cylinder 42-h.p. engine has been running successfully on the Canadian lakes, regularly making trips of 170 miles, for some time past. Messrs. Camper & Nicholsons have just placed an order for 14-h.p. and 7-h.p. sets, and a 45-h.p. auxiliary motor (to their order) has recently been delivered. Work is proceeding on a 45-h.p. 3-cylinder auxiliary set for the Canary Islands and orders are expected for several similar sets.

New Works in Progress at Southampton.—The Tilbury Dredging & Contracting Co. have commenced operations at Thorn Knoll, and the work of removing the spoil will be carried out with all speed in order that a minimum depth of 35 ft. of water may be secured from this point to the dock entrance. The new wet dock, which Messrs. Topham, Jones and Railton are constructing is nearing completion. When completed it will be able to accommodate four of the largest liners building or contemplated. The s.s. *Minnehaha* is still in the Trafalgar Dry Dock undergoing extensive repairs, and refitting. She will be practically a new vessel when she leaves the dry dock, as the refit is of a very extensive nature. Immediately she leaves the dock the work of widening and lengthening the dock will be commenced.

Messrs. Topham, Jones & Railton have secured this contract, and the work will be put in hand without delay. When completed the dock will be one of the largest and finest in the world, easily able to accommodate the new White Star liners or any vessel likely to be constructed for some considerable time. From the above it will be seen that on the completion of the various works the port of Southampton will be able to offer facilities almost unequalled by any other port, which should be a guarantee for its continued prosperity.

Messrs. J. I. Thornycroft & Co., Ltd., Woolston Works, Southampton.—H.M.S. *Larne* was launched in August, and is now fitting out in preparation for her trials. The work on H.M.S. *Lyra*, *Martin* and *Minstrel* is making rapid progress, and the *Lyra* will be launched early this month. H.M. ships *Acheron* and *Ariel*.—The keel blocks for the former ship were laid last month, and frame-bending work is proceeding. Firefloat *Gamma*.—This vessel was launched on the 20th of last month and is now fitting out. 80-ft. Stern-wheel Sawmill Steamer.—This vessel completed satisfactory trials, and was shipped to South America about the beginning of September. She is intended for service on the Amazon. Paddle steamer *Arabia*.—The shell plating is well advanced, and the bulkheads erected. Motor tank barge *Rocklight of London*.—

Work is proceeding on the shell and deck plating of this barge. Launches. Good progress is being made on the three 63-ft. motor boats, and the first vessel is now plated, also work on the 60-ft. twin steam launch is well forward. The repairs department has been occupied with work for the transports *Rewa*, *Rohilla*, *Dongola* and *Plassy*, and the s.y. *Liberty*, also with work in connection with sundry steam pinnaces and launches. The shops have been fully employed with the machinery for the vessels under construction and general work.

The London & South-Western Railway Co.'s new turbine cross-Channel steamer *Cæsarea* arrived at Southampton from the yard of Messrs. Cammell, Laird & Co. about the middle of last month, and proceeded into dry dock. She took up her station in the Company's service to the Channel Islands about the end of the month. The vessel is thoroughly up-to-date and marks a distinct advance in the Company's Channel service. During her trials she realized a speed of 20¼ knots, and this speed was fully maintained during the ensuing six hours' full power run. There is accommodation for 980 passengers. The decorations and upholstery have been executed by the well-known firm of Messrs. Geo. Trollope and Co. A sister vessel, the *Sarnia*, is due to leave the builders' yard early this month, and will follow the *Cæsarea* on the same service. These vessels will be quite equal to any steamer engaged on the cross-Channel service and should become very popular with passengers to the Islands.

THAMES.

(*From our Own Correspondent.*)

The Thames Ironworks Co.—This firm took the opportunity of the presence in London of the Canadian Rifles to entertain the corps and show the members over their yard at Canning Town with the battleship *Thunderer* in progress of construction. It was a happy idea to show the citizens of a colony just starting a Navy an example of the largest type of ship that is built, and it was one that in conjunction with a visit to the Royal Observatory and the Naval College, Greenwich, was much appreciated. This Company will be shortly delivering the new 27-knot ocean-going destroyer *Nantilus*, the vessel having been laid down on April 14th last year. The Company has experienced some difficulty with their men over the night shift work necessary to complete the *Thunderer* in the contract time. The rate is a higher one than for day work and the question we understand, was as to the paying for meal hours. The matter has been settled; it is satisfactory to know this, because any difficulties raised will by past experience surely be to the detriment of all concerned, and the present may be looked on as a test period for shipbuilding work on the river, particularly perhaps as to the rate of construction and keeping time, which has always been the point raised.

The Year's Shipping.—If London does not lead at shipbuilding she does at trading, so the returns just issued show for 1909. The tonnage entering the port was 11,605,698, or about half as much again as at Liverpool and more than twice that registered at Cardiff or Tyne ports. London's increase was about half a million over each of the preceding years.

Shipping Companies.—The new East African service by the Union Castle Line is still prominent, the *Guelph*, which inaugurates it, having only just finally left this country, where from Southampton she had a good send off. The route we have already indicated will be substantially adhered to and all reports speak favourably as to the prospects of the new departure. The circular trip round the Cape thus afforded is also given by the P. & O. Co. through the acquisition of the Lund Line, which enables a passenger to go out by the Suez Canal to Australia and return by the Cape or *vice versa*. A change in this direction foreshadowed on 1st January next is the opportunity of proceeding to China and Japan by the Siberian route and returning by the Canal or reversing the direction of the journey. Another concession on the Australian route is interchange of facilities with Messrs. Geo. Thompson & Co.'s Aberdeen White Star steamers. An addition has just been made to the fleet of the Aberdeen direct line of steamers to Natal and East Africa, of which Messrs. John T. Rennie, Son & Co. are the managers, by the launch of the *Intaba* from Hall, Russell & Co.'s yard at Aberdeen. This vessel is of 6,000 tons and built on the Isherwood system. This and recent vessels of the line are replete with every convenience, the new boat being listed to sail in November on her maiden voyage.

The City Bridges.—In a return recently issued the upkeep of the Tower Bridge, as might be expected, is considerably more than all the others put together, amounting as it does to £15,585. Included in this account is a sum of £1,450 for the hire of a tug to assist vessels in navigating the bridge. The item of lighting alone comes to £1,134 for the Tower Bridge. Compared with the above figures the total amounts standing against London, Blackfriars' and Southwark bridges respectively are £1,494, £1,207 and £989 only.

New Meteorological Office.—This office is to be removed as from October 1st to new quarters in the Imperial Institute Road, South Kensington, the present address in Victoria Street being then no longer required. A new head of this department is to be installed with the larger staff the new premises will accommodate, and for the first time the public will be permitted to use the library of the office, which should be a boon to those interested.

Cadet Training Ships.—The *Port Jackson* which, with the *Medway*, has been acquired by a private company called Devitt & Moore, Ocean Training Ships, Ltd., and managed by that firm, has recently left the Thames for Sydney with forty cadets on board. The vessel, a four-masted barque, will sail round the Cape direct to Sydney, and after discharging cargo will load again and return home *via* Cape Horn, the round voyage occupying about nine months. A naval instructor is carried besides the captain of the vessel.

MERSEY AND MANCHESTER SHIP CANAL.

(*From our Own Correspondent.*)

LIVERPOOL, like all other shipbuilding centres, has recently been feeling the effect of the deplorable lock-out. Notwithstanding this, however, both new and repair work continues to be fairly brisk.

Messrs. Cammell, Laird & Co., Ltd.—The extensive works of this firm continue to be well occupied, and a large list of completed boats for all classes of work have recently left for service. The first of the sister-steamers for the Wallasey Ferry Co. has now been on the service for some weeks, and is proving herself to be a valuable addition to the river fleet. Due to the new Board of Trade regulations regarding the naming of vessels, the name has been changed from *Bluebell* to the *John Joyce*, Mr. Joyce being the chairman of the Ferry Company. Her sister-ship, the *Snowdrop*, is now completed, and is also on the service. The first of the Amazon steamers, the *Sertanejo*, had a preliminary trial on Friday, September 16th, when a speed of 10½ knots was obtained. She has since left for Para. The other two sister-ships are well in frame. Two stern wheelers are being built in angles and frames for transhipment for the Madera Marmore Rly. Co., the vessels being of 180 ft. and 120 ft. respectively. The barge *Sertao*, for the Amazon, has been shipped on steamer's deck, while the tug *Heracles*, which left for Havana recently, under her own steam, has safely reached its destination. The *Cæsarea*, triple-screw turbine steamer for the L. & S.W.Rly., left for Southampton on September 17th after a most successful trial, while her sister-ship, the *Sarnia*, is practically completed. The two destroyers recently ordered by the British Admiralty have been named the *Lapwing* and *Lizard*. These craft will be an improved *Acorn* class. The *Renard* and *Wolverine* left the builders' hands at the beginning of September. The large floating dock is making rapid progress, while work has been commenced upon the two submarine depot tenders, an order for which was recently obtained. The Nelson liner *Highland Brae* has all her machinery aboard, and is rapidly nearing completion. The Midland Rly. Co.'s steamer *Manxman* has been in graving dock for repairs and overhaul. The Liverpool coasting steamer *Pansy* has also been in dock for repairs.

Messrs. H. & C. Grayson have been fairly busy in their several yards. The two tug-boats for the Canadian Pacific Rly. have now been launched, and are nearing completion. The *Latchford* has been in for survey and repairs. The

Nelson liner *Highland Laird* has had extensive repairs, due to the fire which broke out on board recently. The *Almerian* and *Lycidas* have had extensive repairs at the Birkenhead yard, while the coasting steamer *Dunleary* has been overhauled at the Garston yard. The steamer *Talisman* has been repaired at the West Float Graving Dock, while several large tanks have been constructed for shipment abroad.

Messrs. Glover, Clayton & Co. have been busy with a variety of general repair and overhaul work at their Birkenhead yard. Several extensive repair contracts are expected to be in hand shortly.

The International Vanadium Company.—Works have recently been erected at Garston by this Company for the manufacture of Chrome Vanadium Steel and Bronzes. The addition of this alloy to steel has the effect of enhancing its power of resisting the bad effects of alternate stresses. It is claimed that the steel is made tougher by the removal of oxides and nitrides in a fluid form to the slag. The addition of Vanadium for this scavenging work need only be from 0·05 to 0·07 per cent. Other features claimed for this steel are that the Vanadium will pass into the ferrite portion of the metal, making it tougher, while the cost of manufacture is the same or rather less than that of nickel steels, while they possess greater life properties.

The David Wilson Noiseless Winch Co.—This winch, the patent for which has only been in operation for a year or two, is now being largely fitted to all classes of steamers. Amongst recent contracts may be mentioned three steamers belonging to the Great Central Rly. Co.; also the whole ten steamers building for the Nelson line, all of which are being fitted with the winch, the chief feature being the double compound chain, which secures even tension, better drive and absence of vibration.

Wallasey Ferries.—The splendid fleet of steamers owned by the Company, to which the *John Joyce* and *Snowdrop* have recently been added, have been remarkably free from accident of any kind. On the night of September 6th, the passenger steamer *John Heron* collided with the luggage steamer *Seacombe*. The port sponson of the former became fast upon the *Seacombe*. The same Company's steamer *Iris* came to the assistance of the colliding ferries and succeeded in towing the *John Heron* free, and then landed her passengers at Egremont.

The Mersey Docks and Harbour Board.—The Board's dredger, *Walter Glynn*, which was wrecked with loss of two lives near the Seaforth Battery some weeks ago while performing preliminary work in connection with the dock extension, is now being salved. The heavy buckets and crane have been removed, and it is hoped to right her by means of powerful shore winches.

The Blue Funnel Line.—With the advent of the inauguration of this Company's service from Fishguard in November next, following close upon the anniversary (on September 5th) of the *Mauretania's* first call at this port, its prominence is assured. The *Æneas*, recently launched by Messrs. Workman & Clark, is expected to run her maiden voyage in October, while her sister-ships, the *Ascanius* and *Anchises*, with over 10,000 tons register, will shortly be launched. These boats will be run by Messrs. Alfred Holt between Glasgow, Fishguard and Australia.

BELFAST.

(From our Own Correspondent.)

Messrs. Harland & Wolff.—Before these notes are in print this firm will have launched from the south end of the Queen's Island a twin-screw steamer named *Themistocles*, which has been built for Messrs. George Thompson's well-known Aberdeen line. Messrs. Harland & Wolff have another vessel on the stocks for the same owners. This steamer was ordered to replace the *Pericles*, which struck a coral reef near Cape Leeuwin in the spring of this year and foundered in deep water, fortunately without loss of life. But, whereas the latter vessel was twin-screw, the new one will be propelled by three screws, the engines being what has come to be commonly known as combination machinery, that is, the wing propellers are driven by reciprocating engines, and the centre propeller by a turbine, which takes its power from the exhaust steam of the low-pressure cylinders of the reciprocating engines. Amongst other concerns for whom the Queen's Island have fresh tonnage under construction may be mentioned the White Star Line, Hamburg-America Line and Bibby Line. They have also recently received an order for a new twin-screw steamer for the Belfast Steamship Company's service between Belfast and Liverpool.

Messrs. Workman, Clark & Co.—Within a few days of writing this firm will launch a large twin-screw steamer for Messrs. J. P. Corry & Co., of London. They recently sent from the stocks a fine new twin-screw liner named *Æneas*, built to the order of the Ocean Steamship Co., Liverpool (A. Holt & Co.). The launch of this vessel was an important event, marking as it did the advent of Messrs. Holt & Co. into the Australian passenger trade. The dimensions of the *Æneas*, the first of the vessels under construction for this trade, are:—Length, 509 ft.; moulded breadth, 60 ft.; and moulded depth, 40 ft. It is not necessary to give here a description of the vessel, full particulars appearing elsewhere. Messrs. Workman, Clark & Co. have three other vessels in hand for the same owners, and had to decline the order for a fourth, being booked up so far ahead as to prevent their giving delivery in anything like the time required. They have also just completed extensive bottom damage repairs to the *Agamemnon*, owned by Messrs. A. Holt & Co.

Messrs. MacColl & Co., in addition to other work, have recently carried out general overhaul of the Belfast steamer *Alice M. Craig*, and bow damage repairs to the French barque *Dupleix*.

MARINE BOILER EXPLOSIONS.

From the Board of Trade Reports.

REPORT No. 1906 deals with the explosion from the main boiler of the s.s. *Locksley*. The explosion occurred on the 10th December, 1909. No one was injured by the explosion. The boiler is of the cylindrical vertical type, having an upright firebox, one cross tube, and a central vertical uptake, and is made of steel. It is 6 feet 6 inches in mean internal diameter, and 13 feet 6 inches high. The explosion was not of a violent nature. The side of the firebox collapsed, and the plate through which one of the stays passed was drawn over the end of the stay, and the contents of the boiler escaped through the stayhole, which was $1\frac{7}{16}$ inches in diameter. The explosion was caused by the firebox plates becoming overheated through allowing an accumulation of salt, scale and dirt to collect upon them in the narrow water-space between the firebox and the shell. The plates were not wasted to any appreciable extent. The observations of the Engineer Surveyor-in-Chief are as follows:—The explosion in this case appears to have been caused by the overheating of the furnace plates, consequent on an accumulation of scale upon them, and the presence of scale $\frac{1}{2}$ inch thick is evidence of the fact that the management of the boiler was not as it should have been.

Report No. 1908 deals with the explosion from a boiler on board the steam drifter *Pursuit*. The explosion occurred about 9.30 a.m. on Wednesday, the 10th November last. No person was injured by the explosion. The boiler is of the single-ended marine type, and is made of steel. It is 8 feet in length over all and 9 feet in diameter. A hole, which is said to have been about $\frac{1}{4}$ inch by $\frac{5}{16}$ inch, was formed in a patch which had been fitted over a stay in the bottom of the combustion chamber. Through this hole the contents of the boiler escaped into the stokehold, and the vessel became disabled. The explosion appears to have been due to corrosion on the fire side of the patch, caused by leakage from the stay which passed through the middle of it, in consequence of which the plate became gradually reduced in thickness until it could no longer withstand the ordinary working pressure. The observations of the Engineer Surveyor-in-Chief are as follows:—This report deals with an explosion from the boiler of a steam drifter, due to the wasting of a patch which had been fitted, as a repair, on the bottom of the combustion chamber wrapper plate. The fitting of this patch was necessitated by the corrosion of the plate itself, due to leakage from a screwed stay in its

vicinity. This former wasting should, it is thought, have called attention to the necessity for carefully examining the bottom of the combustion chamber, as also of all other parts of the boiler, and so have prevented the explosion dealt with in the present instance.

Report No. 1912 deals with the explosion from the main steam pipe on board the steam trawler *Dauntless*. The explosion occurred about 5.30 p.m. on the 13th October last. No one was injured by the explosion. The steam pipe, which was made of solid drawn copper, was $3\frac{3}{4}$ inches in diameter internally, ·153 to ·164 inch in thickness, about 11 feet in length. The pipe fractured longitudinally, in two places, near the flange by which it was connected to the engine stop valve chest, for lengths of about $2\frac{3}{4}$ and $1\frac{1}{2}$ inches respectively, and through these fractures the steam escaped violently. The failure of the pipe appears to have been due to the effect of the repeated stresses set up by the vibrations arising from the working of the machinery. The observations of the Engineer Surveyor-in-Chief are as follows : Adequate provision for the movement of steam pipes under ordinary working conditions is frequently lacking, and this is another instance of the failure of a steam pipe from such a defect, but fortunately the results were not serious.

Report No. 1916 deals with the explosion from a main steam pipe junction piece on board the s.s. *Waimate*. The explosion occurred about midnight on the 14th August last. No person was injured by the explosion. The junction piece was a brass casting, and connected the main steam pipes on the three main boilers with the main steam pipe to the propelling engines. The average thickness of metal in it was $\frac{7}{8}$ inch. The propelling engines were stopped, and while some repairs were being made to them, the main stop valves on the boilers were closed. When the boiler stop valves were again opened, steam was observed to be escaping from a crack, about 7 inches long circumferentially, on the under side of the junction piece and near to the flange by which it was jointed to the centre boiler stop valve. The explosion was due to the movement of the main steam pipe, caused by the violent racing of the engines during heavy weather between 9th and 14th August, 1909. The observations of the Engineer Surveyor-in-Chief are as follows :—In this case a crack, 7 inches long, developed in a junction piece connecting the main steam pipes with the steam pipes from each of the three main boilers. The crack was of a serious character, but the vessel, fortunately, was able to make port, unaided, four days afterwards, where repairs were effected.

REVIEWS.

Steamships and their Story. By R. A. Fletcher. 16/- nett. London : Sidgwick & Jackson.

This volume is identically of the same title as a similar book reviewed last month. In the first portion of the volume illustrations are given of some of the earliest attempts by inventors to bring forward a mechanical means to take the place of wind and labour. It was not until the end of the eighteenth century that American inventors, amongst whom Robert Fulton is included, turned their attention to the problem of navigation by steam, but the claim of Robert Fulton to be the first inventor of a practical steamboat is here discounted, others about the same time being credited with having made steamboats which were tried but did not make any material success as to their speed. This gives rise to a complete chapter on American Pioneers, where the history of the steamboat is carried on nearly up to the present date, including such marvels as the *Mary Powell* and the *Hendrick Hudson*, which made something like 27 miles an hour. The finest passenger steamer placed on the lakes in the United States was the *City of Cleveland*, which was 400 feet over all. She has seven decks, the main deck, which is of steel, being sheathed with wood, to deaden the noise of the handling of cargo. The engines have three cylinders, with one high-pressure cylinder, 54 inches diameter, arranged between two low-pressure cylinders of 82 inches diameter. This is a marvellous creation for the passenger traffic on the lakes. There is next a long chapter on the progress of steamship building in Great Britain, where William Symington is given the credit of being one of the first inventors here in 1786. This is followed up with particulars and illustrations of the *Comet*, built by Robert Robertson, and in 1822 the St. George Steam Packet Company were credited with two large and powerful steamers of about 600 tons. We then get on to the final types of steamers in about 1860, owned by the old well-known firms of Messrs. H. Powell & Co., Messrs. Alexander Laird & Co., and Messrs. Samuel Hough & Co. After a chapter upon the opening of the trans-Atlantic service, the adaptation of steam auxiliary service to sailing vessels is well dealt with. We then come to the establishment of iron for ship building, which gave the first impetus to the better development of steam power to vessels, until now the proportion of sailing vessels to steam vessels is only about one to nine. Steam power as applied, not only to our Navy, but to other Navies, is well considered, with a capital set of illustrations, and the book closes with examples of floating docks and miscellaneous steam vessels that have been built for special purposes. The work contains 150 illustrations.

The Law and Practice relating to Patents and Designs. By David Fulton. 15/- nett. 4th edition. London : Jordan & Sons, Ltd.

This book, by the well-known author, David Fulton, Barrister-at-Law, has already been through three editions, but as the Patent and Designs Act of 1907 has consolidated the legislation extending from 1883 to 1907, it has become necessary to issue a fourth edition, upon the 1907-8 Acts, which have now become the particular Acts for regulating all the procedure in the matter of Patents and Designs. We note that in the chapter upon procedure in obtaining Patents the author does not consider the alternative now open to the patentee in filing intermediate provisional specifications, which may embody what has been found out in working up an invention upon the original application during the six months allowed for completing the application. It is well to know that applicants are able to complete in one document or final specification, not only the first provisional filed, but two, three or more of such provisionals that may be filed as additions to the first provisional. This largely increases the ground upon which applicants may proceed up to a final specification, which, though founded upon the first Provisional, may include what has proved to be quite distinct matters during the working out of the final application. The author's remarks upon essential subject matter, invention, novelty and utility, are well worth reading, covering as they do five chapters. Also the following chapters upon the title, the provisional and complete specifications, with the claims, comprising four chapters, are well worthy of the attention of those who are desirous of filing an application for themselves. The chapter upon the revocation of Patents deals with the new Act, which allows any person to apply for the revocation of patents granted to foreigners who have not placed the working of their patents to an adequate extent in this country. There has grown up under this new Act a considerable number of complete applications, which are now applied for as additions to prior-dated patents, by which means a single further fee, paid annually, is sufficient to keep extant both the original patent and others afterwards granted as additions to this first patent. It must be remembered that these patents of addition are only allowed to exist for the time for which the first patent, which forms the ground-piece of the edifice, is allowed to run. The whole book is well written, and is well worth its cost to those interested in the matter.

Submarines of the World's Navies. By Charles W. Domville-Fife. Illustrated. London : Francis Griffiths, 34, Maiden Lane, Strand. 21/- nett.

In spite of many shortcomings, both in its plan and execution, this is a book of some interest, owing to its being about a very interesting subject. In Part I., separate chapters are devoted to the submarine flotillas of each of the different Powers, which are described in some detail. The information is given in the form of short notes instead of as a comprehensive account, and is abundantly illustrated. It is a pity that the author has not realized the advantage of writing his book up to a definite period of time. Thus the first

sentence about British submarine flotillas states that England will possess more than sixty boats "when those named in the naval programme for 1909-10 are built." It would have been better could the actual date and actual number have been stated, more particularly as it seems that the completion of the 1909-10 submarines will increase the total to seventy-five vessels, while already there are more than sixty in commission without any of the 1909-10 programme at all. In the statement, too, that the United States submarines number "twelve vessels built and fifteen *almost* completed," the same defect is apparent. The section, however, contains a good deal of somewhat ancient information about submarines, their design, performances, and capabilities. There is no mention under Sweden of the modern boat *Hvalen*, although a full description appears of the *Hajen*, which was launched in 1904. Built in Italy, the *Hvalen*, after a series of tests, made the voyage to Sweden, a distance of over 4,000 miles, without convoy of any kind, occupying two months on the journey. In Parts II. and III. have been compiled a series of articles, letters, and notes upon different phases of submarine warfare by various writers. Admiral Sir John Hopkins favours a small type of submarine to be carried by specially constructed mother ships and launched down an inclined plane in the stern of such vessel when required for oceanic use. Admiral Sir Cyprian Bridge discusses the tactical value of submarines as compared with torpedo boats, and concludes that while the submarine in naval war would be of value in certain circumstances, such circumstances will only be of rare occurrence. Sir Arthur Trevor Dawson, of Messrs. Vickers, is represented by an extract from a lecture he delivered in 1901, and there are also contributions from M. Bertin, of the French Navy, Captain Edgar Lees, R.N., and Mr. L. Y. Spear, of the American Navy, all of whose views are of interest. They would have been of greater value had they been revised and brought up-to-date. The illustrations are numerous, and varied, but while the book may be a source of pleasure to the layman who desires to learn something about the submarine boats of the world, it cannot have much attraction for the naval officer and professional student.

CATALOGUES.

We have received from the following firms—

The Newall Engineering Co.—A catalogue of gauges, micrometers, and measuring machines.

Dermatine Company, Ltd.—Price lists 17, 18, 19 and 20 of Dermatine belting; rings; hose and tubing; and Dermatine valves.

Messrs. John Spencer, Ltd.—Catalogue of their iron and steel tubes and fittings.

Consett Iron Co., Ltd.—A table of equivalent divisions of an inch.

Messrs. W. F. Dixon & Co.—Circulars of their specialities in both Buffalo-raw-hide and Waterproof-paper-gears.

S. N. Brayshaw.—Particulars of the Brayshaw patent salt-bath furnace for hardening steel.

Verity's, Ltd.—The Aston electric radiators and Crystal glass fittings.

BOOKS RECEIVED.

Reed's Guide to the Engineer's Extra First-Class Examination. Sunderland: Thomas Reed & Co., Ltd. Price, 18/- nett.

Design of Marine Multitubular Boilers. By James D. McKnight and A. W. Brown. London: The Technical Publishing Co., Ltd. Price, 3/6 nett.

THE BOWESFIELD STEEL CO., LTD., inform us that they have been awarded a Gold Medal at the Japan-British Exhibition for their exhibit of Steel Sheets—black and galvanized, plain and corrugated—and accessories.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Berwindmoor.—On August 6th, Messrs. Sir Raylton Dixon & Co., Ltd., launched from their Cleveland Dockyard, Middlesbrough, a fine steel screw steamer which is believed to be one of the largest merchant colliers yet built. The vessel is being constructed for American owners and is of the builders' latest improved patent cantilever framed type with topside water ballast tanks, shelter-deck type with engines aft. The principal dimensions of the steamer are 425 ft. long by 54 ft. beam by 29 ft. moulded, and she will have a deadweight carrying capacity of over 8500 tons on a light draught of water. Triple-expansion engines having cylinders 28 in., 46 in. and 77 in. by 48 in. stroke, supplied with steam by three large single-ended boilers, fitted with Howden's system of forced draught, which are estimated to drive the vessel a speed of 11½ knots loaded, will be fitted by Messrs. Richardsons, Westgarth & Co., Ltd., of Hartlepool.

Signe.—On August 8th, there was launched from the yard of the Sunderland Shipbuilding Co., Ltd., a steel screw steamer, length between perpendiculars 290 ft., breadth extreme 42 ft, and depth moulded 21 ft. 6 in., having poop, bridge and topgallant forecastle, built to Lloyd's highest class, under special survey. The vessel will carry 3550 tons deadweight on a light draught of water, and is fitted with water ballast in cellular bottom and peak. Seven steam winches, steam-steering gear, large donkey boiler and direct steam windlass are fitted. The engines are by the North-Eastern Marine Engineering Co., Ltd., Sunderland, and have cylinders 22 in., 36 in. and 59 in. by 39 in. stroke, steam being supplied by two large boilers working at a pressure of 180 lbs. per square inch. The vessel has been built to the order of M. S. Pedersen, Esq., of Tonsberg, and during construction has been inspected by Messrs. Bushell & Nicol, of Newcastle.

City of Bombay.—On August 8th, there was launched from the yard of Messrs. Palmers' Shipbuilding & Iron Co., Ltd., Jarrow, the handsomely-modelled screw steamer *City of Bombay*, which has been built to the order of the Ellerman Lines, Ltd., of London and Liverpool. The vessel is over 400 ft. long, and will receive the highest class in Lloyd's Register. She has complete 'tween decks, with long bridge, poop and forecastle; and is fitted with longitudinal girders under the beams and wide-spaced hold pillars, giving clear holds for cargo. Water ballast is provided for in cellular double bottom; also in deep tank and in after peak. Accommodation is provided for captain, officers and a few spare berths in steel houses on bridge deck amidships, the crew being berthed in topgallant forecastle. The vessel is lighted by electric light throughout, and is fitted with a very complete system of derrick and steam winches for rapid working of cargo; she has been designed to carry about 8400 tons deadweight. The vessel is to be fitted with triple-expansion engines, also manufactured by the builders, which will give her a speed of between 11 and 12 knots.

Deneside.—On August 8th, Messrs. J. T. Eltringham & Co., South Shields, launched from their yard a fine screw vessel, the *Deneside*, which has been built to the order of Mr. Thomas Rose, of Sunderland, and is intended for the general coasting trade. She is 141 ft. over all, and has been constructed with large cubic capacity, clear hold and large hatches. The machinery will be supplied from South Shields, the engines having ample power to drive the vessel through the water at the rate of 9 knots per hour. She will carry 250 tons deadweight.

Steel Screw Tug.—On August 8th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw tug, the principal dimensions being 75 ft. by 21 ft. by 10 ft. 2 in. moulded. The vessel has been built to the order of Mr. J. Constant, of London, and will be fitted with powerful triple-expansion engines by Messrs. Earles' Shipbuilding & Engineering Co., Ltd., of Hull, and is replete with all the latest improvements for this class of vessel.

Forester.—On August 8th, there was launched from the yard of Messrs. E. Finch & Co., Ltd., a screw steamer built to the order of Messrs. W. Jones & Son, of Lydney, Glos.

Her dimensions are :—Length, 102 ft. ; breadth moulded, 22 ft. ; depth moulded, 9 ft. 6 in., to carry a deadweight cargo of 200 tons. She is now being fitted with compound engines of 250 horse power.

Ryburn.—On August 8th, Messrs. William Gray & Co., Ltd., launched the handsome steel screw steamer *Ryburn* for Messrs. J. R. Murrell & Son, West Hartlepool. She will take the highest class in Lloyd's and is of the following dimensions :—Length overall, 342 ft. ; breadth, 46 ft., and depth, 24 ft. 4 in., with long bridge, poop and topgallant forecastle. The hull is built with deep frames, cellular double bottom and large aft-peak tank for water ballast, six steam winches, steam-steering gear amidships, hand-screw gear aft, patent direct steam windless, large horizontal multitubular donkey boiler, shifting boards throughout, stockless anchors, telescopic masts with fore and aft rig, and all requirements for a first-class cargo steamer. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 24 in., 36 in. and 64 in. dia. with a piston stroke of 42 in., and two large steel boilers for a working pressure of 180 lbs. per square inch. The trial trip was run on the 10 Sept. and a speed of 11 knots was maintained.

Fulgent.—On August 9th, Messrs. Short Brothers, Ltd., launched from their shipyard at Pallion, Sunderland, the s.s. *Fulgent*, built to the order of James Westoll, Esq., of Sunderland. She is built on the Isherwood system of longitudinal framing to take Lloyd's highest class, with one deck laid, poop, bridge and forecastle. Her leading dimensions are :—Length, 291 ft. ; beam, 40 ft. 6 in., and depth moulded, 20 ft. 9 in. The vessel is the first collier to be built on the Isherwood system and has been designed with extra large self-trimming hatches and clear holds, to facilitate prompt loading. For quick discharging sixteen derricks are fitted, with tables on masts and outriggers above. Cellular double bottom for water ballast is provided throughout and the fore and after-peaks are also to be used for water ballast. Steam windlass, steam-steering gear fitted in engine-room, controlled from the flying bridge and connected by rods and chains to quadrant on rudder, six steam winches are supplied, taking steam from patent vertical donkey boiler working at 90 lbs. pressure. Hand-steering gear is fitted aft. The propelling machinery is under construction by Messrs. George Clark, Ltd., of Sunderland, and consists of engine with cylinders 20½ in., 33 in., 54 in. diameter and a stroke of 36 in., driven by two powerful multitubular boilers of 180 lbs. pressure.

Moorlands.—On August 9th, this vessel was launched from the yard of Messrs. Wm. Doxford & Sons, Ltd., Sunderland, having been built for Messrs. Charles Smales & Son, Whitby, and was christened by Miss Mabel Smales. The vessel carries 6400 tons on 21¼ ft. draught, and is fitted with tri-compound engines and high-pressure boilers, also built by Messrs. Doxford. The *Moorlands* is built to Lloyd's 100 A1, and is on the single-deck principle with long bridge. The trial trip was run on the 2nd Sept.

Wedgwood.—On August 22nd, Messrs. Robert Thompson and Sons, Ltd., launched from their Southwich Yard the finely modelled self-trimming collier *Wedgwood*, built to the order of Messrs. Wm. France, Fenwick & Co., Ltd., of London and Sunderland. The vessel is of the raised quarter and well-deck type and will take the highest class at Lloyd's. Her principal dimensions are :—Length overall, 274 ft. 3 in. ; breadth, 38 ft. ; depth moulded, 18 ft. 2 in., and she will carry about 2310 tons deadweight on a light draught of water, and is fitted with bulb-angle framing, the holds being left clear of all obstructions. There are four very large hatchways arranged to make her perfectly up-to-date as a self-trimmer and to facilitate rapid loading. Four powerful steam winches with latest improvements are supplied, with steam from a large vertical donkey boiler, and in addition to the usual derricks four gaffs are fitted, the masts being amply strengthened for this purpose. To enable her to make quick return voyages ample water ballast is provided throughout the cellular double bottom and in fore and after peaks, the former being divided longitudinally and athwartships for trimming purposes, and fitted with large tank suction pipes and extra large ballast donkey for quickly pumping out water ballast. The inside of holds, bunkers and engine and boiler-room tanks are coated with enamel. The mooring arrangements have also received special attention, steel wire compressors being fitted on the poop and forecastle decks, as well as the usual large fairleads and bitts. At the forward end of the main bridge a steel house is arranged for the captain, with lower flying bridge on top, also teak chart house, the latter carrying upper flying bridge. The engines of the triple-expansion type are by Messrs. The North-Eastern Marine Engineering Co., Ltd., Sunderland, having cylinders 21½ in., 36 in. and 59 in., with a stroke of 39 in., steam being supplied by two extra large boilers working at 180 lbs. pressure. During construction the vessel and machinery have been under the personal supervision of Messrs. Thompson & Eyres, of Sunderland.

Artemis.—On August 23rd, Messrs. Ropner & Sons, Ltd., of Stockton-on-Tees, launched from their yard a steel screw steamer of the following dimensions, *viz.* :—Length (about), 424 ft. ; breadth, 54 ft. ; depth (to shelter deck), 36 ft. 3 in. The vessel is built to the highest class in the British Corporation Registry to carry about 9500 tons, she is for foreign account and is fitted with both shelter and upper decks, with five holds and large hatchways, thus facilitating rapid loading and discharging. The vessel is built on the deep frame principle, the frames being of Channel steel, and the holds are clear of all obstructions to the stowage of cargo, there being no hold beams or stringers. She has capacity for about 2100 tons of water ballast in her cellular bottom and peak tanks. Her measurement capacity is exceptionally large, and she is fitted with eleven powerful steam winches, working in conjunction with eleven derricks, with wire runners and purchase spans. Steam is supplied to the deck machinery from either of three main boilers of the horizontal multitubular type. The outfit includes stockless anchors, quick-warping steam windlass, steam-steering gear amidships and powerful screw gear aft. The engines are of the triple-expansion type by Messrs. Blair & Co., Ltd., of Stockton-on-Tees, of about 2000 i.h.p., on a very full specification, with three boilers 15 ft. by 11 ft., working at a pressure of 180 lbs.

Como.—On August 23rd, a handsomely modelled steamer, built to the order of Messrs. Thos. Wilson, Sons & Co., Ltd., for their Liverpool and Christiania trade was launched from the yard of Messrs. Earle's Shipbuilding & Engineering Co., Ltd., Hull. The principal dimensions are :—Length, 250 ft. ; breadth, 35 ft. ; depth, 18 ft. moulded. She has been constructed of steel to the British Corporation Registry's highest class and to the Board of Trade latest requirements. The vessel is of single-deck type with short poop, long bridge and topgallant forecastle, and will be fitted with two pole masts to suit Manchester Ship Canal regulations and is capable of carrying a large quantity of water ballast. A commodious deck house has been provided on the bridge deck amidships for the accommodation of captain, officers, engineers and steward. The petty officers, seamen and firemen are berthed in the forecastle. She will be fitted with all necessary derricks and cargo gear, four steam winches, steam windlass and steam and hand-steering gear.

Fenay Bridge.—On August 23rd, this vessel was launched by Messrs. Joseph L. Thompson & Sons, Ltd., of the North Sands Shipbuilding Yard, Sunderland, and has been specially constructed to the order of Messrs. The Fenay Steamship Co., Ltd., of London, and is the second vessel Messrs. Thompson have built for this Company. The principal dimensions of the vessel are :—Length, 370 ft. ; breadth, extreme, 51 ft. ; and depth moulded, 26 ft. 4½ in. The vessel has been built to Lloyd's highest class on the single-deck principle, and to a high-class specification. The propelling machinery has been constructed by Messrs. Blair & Co., Ltd., of Stockton-on-Tees, the sizes of the cylinders being 25 in., 41 in., 67 in. by 45 in. stroke, supplied with steam by two large boilers working at 180 lbs. pressure.

Steel Screw Steamer.—On August 23rd, there was launched from the yard of the Sunderland Shipbuilding Co., Ltd., a steel screw steamer 346 ft. long between perpendiculars by 50 ft. 10 in. broad by 25 ft. 6 in. deep, having poop, bridge and topgallant forecastle, classed 100 A1 Lloyd's under special survey. The vessel is of the single-deck type and her deadweight carrying capacity is 6350 tons upon a light draught of water. Accommodation is placed on the bridge for officers and engineers, whilst the sailors and firemen are berthed in the forecastle as usual. The saloon is in a deck house at the fore end of bridge, and is fitted up in polished

hardwoods with berths for captain and officers. A large marine type donkey boiler is supplied for driving the deck machinery, which consists of six steam winches, steam-steering gear and direct steam windlass. The main engines are by the North-Eastern Marine Engineering Co., Ltd., Sunderland, having cylinders 24½ in., 40 in. and 66 in. by 45 in. stroke, steam being supplied by two large boilers working at a pressure of 180 lbs. per square inch.

Eileen Duncan.—On August 24th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 120 ft. by 22 ft. by 12 ft. 4 in. moulded. The vessel has been built to the order of Messrs. J. Duncan, Sons & Co., Liverpool, and will be fitted with powerful triple-expansion engines by Messrs. C. D. Holmes & Co., Ltd., of Hull, and is replete with all the latest improvements for fishing purposes.

Farn.—On August 25th, Messrs. Wm. Doxford & Sons, Ltd., Pallion Yard, Sunderland, launched the screw steamer *Farn*, built to the order of Messrs. Farrar, Groves & Co. for the Fargrove Steam Navigation Co., Ltd. She is to be fitted with tri-compound engines by Messrs. Doxford, and is to carry about 7500 tons. She is built on the single-deck principle, with modern construction, deep frames, no side stringers, and clear holds with centre steel bulkhead fore and aft in holds between hatchways, and is classed 100 A1 at Lloyd's. The cabin accommodation is to be fitted in commodious houses on the bridge deck amidships, leaving the vessel large stowage capacity. She will be fitted with a very full complement of the latest system of cargo gear.

Boverton.—On September 2nd, there was launched at Sunderland the screw steamer *Boverton*, which has been built for Messrs. Evan Thomas, Radcliffe & Co., of Cardiff. She is of 4750 deadweight capacity, and is fitted for rapid loading and discharging. She has absolutely clear holds and very large hatches.

Renee Marthe.—On September 2nd, Messrs. Osbourne, Graham & Co. launched from their yard at Hylton the steel screw steamer *Renee Marthe*, which they have specially constructed to the order of Fernand Bouat, Esq., of Caen. The vessel is a single decker 259 ft. by 35 ft., built to carry 2100 tons on a very shallow draught, and is of the self-trimming collier type. Rooms for the captain and officers are tastefully fitted out in hardwood and are of large size. The steamer is fitted with the most modern appliances of economical and quick working of cargo. She has been constructed to Lloyd's highest class and also complies with the requirements of the French Law. After the launch the vessel proceeded to the works of the North-Eastern Marine Engineering Co., Ltd., of Sunderland. for her machinery, which has been designed to drive the vessel a speed of 10 knots loaded.

Norfolk Coast.—On September 3rd, Messrs. W. Harkess and Son, Ltd., launched from their yard at Middlesbrough a steel screw steamer for Liverpool owners. She is designed to carry 1025 tons on very light draught. She has large self-trimming hatches and clear holds, and is fitted with special heavy deck machinery for quick handling of cargoes. Her engines are by Messrs. Richardsons, Westgarth & Co., Ltd., of Middlesbrough, and are capable of driving her a speed of 10½ knots loaded.

Marsden.—On September 5th, there was successfully launched from the shipbuilding yard of Messrs. Wood, Skinner & Co., Ltd., at Bill Quay, Newcastle-on-Tyne, a handsome new steel screw collier which has been built by them to the order of Messrs. The Burnett Steamship Co., Ltd., of Newcastle-on-Tyne. This vessel is a sister ship to the s.s. *Towneley*, recently constructed for the same owners by the builders. She is of the long raised quarter-deck type with bridge and topgallant forecastle and has specially large hatches for self-trimming purposes. Water ballast is provided in the cellular double bottom all fore and aft, and in the fore and after-peak tanks. The vessel is rigged as a two-masted schooner and will be fitted with all the most modern appliances in the way of deck machinery for facilitating the rapid handling of cargo both in loading and discharging. The propelling machinery will be of the improved triple-expansion type, supplied with steam from two large steel multitubular boilers, and has been constructed and will be fitted by Messrs. The North-Eastern Marine Engineering Co., Ltd., of Wallsend-on-Tyne. Both the ship and engines have been built under the special survey of Lloyd's for their highest classification.

Hope (T.B.D.).—On September 6th, there was launched from the Wallsend Shipyard of Messrs. Swan, Hunter and Wigham Richardson, Ltd., the ocean-going torpedo-boat-destroyer *Hope*, which has been built for the British Admiralty. This vessel is one of the twenty destroyers of the *Acorn* class which were ordered for the Naval programme of 1909-10. The main propelling machinery is being constructed by the Wallsend Slipway & Engineering Co., Ltd., and consists of Parsons steam turbines driving three propellers on separate shafts. The last-named firm have also made the water-tube boilers, which are of the Yarrow type and fired by oil fuel. There are four of these, which were put on board before the launch. It is expected that very shortly she will be ready for her steam trials. The specified sea speed is 27 knots an hour.

Albeira.—On September 7th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 130 ft. by 23 ft. 6 in. by 13 ft. moulded. The vessel has been built to the order of Messrs. The Crown Steam Fishing Co., Ltd., Grimsby, and will be fitted with powerful triple-expansion engines by Messrs. Amos & Smith, Ltd., of Hull, and is replete with all the latest improvements for fishing purposes.

Blackburn.—On September 7th, was launched the third of the five steamers ordered from Messrs. Earle's Shipbuilding and Engineering Co., Ltd., Hull, by the Great Central Railway Co. for quick passenger and cargo service between the ports of Grimsby and Hamburg. The principal dimensions are :—Length, 265 ft. ; breadth, 36 ft. ; extreme depth, 18 ft. 6 in. moulded. The vessel is constructed of steel, and has been built under special survey to Lloyd's 100 A1 class, Board of Trade latest rules, and in accordance with the German Emigration Laws and the Hamburg Harbour authorities' requirements. She is of one-deck type, with poop, long bridge and topgallant forecastle. There is ample accommodation for passengers—state-rooms for about 100 first-class are arranged in a commodious house on bridge deck, with several four-berth cabins on main deck. A special state-room of large dimensions, fitted up in luxurious style, is provided on main deck amidships. Rooms for about ten second-class passengers are arranged under the poop. The third-class passengers, about 300 in number, will be berthed in fore and after 'tween decks. The first-class ladies' lounge, entrance hall and gent.'s smoking-room are situated on bridge deck, with extensive promenade spaces in the vicinity. The saloons are arranged on main deck, that for first-class extending to the sides of the vessel. The lavatory accommodation is extensive, and the ventilation of these compartments has received special consideration. The arrangement and fitting of galleys, pantries, etc., are thoroughly up-to-date, and include all the latest improvements. The vessel is provided with all necessary cargo gear for rapid loading and discharge, and will be fitted with a special type of steam, hand and telemetor steering gear. A complete installation of steam heating, electric lighting, bells and telephone will be fitted. The machinery will consist of a set of triple-expansion surface-condensing engines having cylinders 22 in., 35 in., 60 in., by 42 in. stroke, indicating about 2000 h.p. Steam will be supplied by two large cylindrical boilers working at a steam pressure of 180 lbs. per square inch.

LAUNCHES—Scotch.

Kulambangra.—On August 25th, there was launched from the yard of Messrs. Napier & Miller, Ltd., Old Kilpatrick, the handsome twin-screw steamer *Kulambangra*, built to the order of Messrs. Lever Bros., Ltd., Port Sunlight. The dimensions of the vessel are :—Length, 265 ft. ; breadth, 37 ft. ; depth, 26 ft. 3 in., with a gross tonnage of about 2,000 tons, built under the rules of Lloyd's register for their highest class. The vessel is rigged as a two-masted schooner, has upper, awning and promenade decks, water ballast in double bottom and fore and aft peak tanks. Accommodation for thirty-six first-class passengers has been provided amidships in state-rooms on the upper deck. A large deck-house has been built on the awning deck, containing first-class

dining saloon, entrance hall and owner's state-rooms, with smoke-room above on promenade deck. The vessel, which is intended for trading in tropical climates, has been fitted with refrigerating plant, with large cold-storage chambers, electric light, steam windlass, steam-steering gear with telemotor gear, and five steam winches. The machinery is being supplied by Messrs. J. G. Kincaid & Co., Ltd., Greenock, and consists of triple-expansion engines with cylinders 13½ in., 22½ in., 37 in., with 33 in. stroke, and two boilers of large size, 180 lbs. working pressure. Messrs. Matthew Keenan & Co., Ltd., had the contract for covering the boilers and steam pipes.

Beam.—On Sept. 1st, there was launched at Port Glasgow with machinery aboard, the powerful twin-screw tug *Beam* which has been built for the Port of London Authority. The machinery consists of two sets of compound surface-condensing engines of over 1,000 horse-power, and two water-tube boilers. The vessels have complete outfits of auxiliary machinery, and are specially adapted for working in the London docks.

Strathan.—On Sept. 1st, Messrs. Archd. McMillan & Son, Ltd., Dumbarton, launched the steel screw steamer *Strathan*, which is the third of four vessels ordered from this firm by Messrs. Burrell & Son, Glasgow. The vessel is of the following dimensions, *viz.* :—Length, 390 ft. ; breadth, 52 ft. 3 in. ; depth, 28 ft. ; and is constructed with clear holds. Large water ballast capacity is provided for in cellular double bottom, aft peak, and in deep tank amidships. All up-to-date appliances are provided for the rapid handling of cargo, including twelve derricks and ten powerful steam winches. Accommodation is fitted on top of bridge deck for captain, officers and engineers, and the crew are berthed forward. Electric light is installed throughout the vessel. The machinery is being supplied by Messrs. David Rowan & Co., Glasgow, and both vessel and machinery have been built under special survey of the British Corporation for their highest class.

Malanbar.—On Sept. 3rd, there was launched at Ardrossan a twin-screw steamer, which has been built to the order of the North Coast Steam Navigation Company, Australia, The dimensions of the vessel are : Length, 155 ft. ; breadth, 28 ft. ; depth, 10 ft. She will be fitted for passenger and goods traffic on the Australian coast, and has been built to British Corporation special class under special survey.

Explorer.—On Sept. 5th, there was launched on the Clyde the steel screw steamer *Explorer*, which has been built to the order of Messrs. T. & J. Harrison, Liverpool. The new vessel, which is constructed to Lloyd's highest class, is fitted with the latest appliances for the rapid and efficient working of cargo. Messrs. Matthew Keenan & Co., have the contract to cover the boilers and steam pipes on board.

St. Lawrence.—On Sept. 6th, Messrs. Wm. Simons & Co., Ltd., launched from their works at Renfrew, to the order of the Director of Works of the Admiralty, a "Simons" Patent Cutter Suction Hopper Dredger, named the *St. Lawrence*, of 2,000 tons hopper capacity. Dredging clay and other hard material by means of a spiral cutter is only a recent development in dredge building, the *St. Lawrence* being the first of her type constructed in the United Kingdom. Her arrangements are as follows :—An independent set of triple-expansion engines for driving the dredging pump, with a complete installation of auxiliary machinery, are fitted in a separate engine-room immediately in front of the hopper compartment. Steam for the propelling and pumping engines and all machinery throughout the dredger is supplied by three marine type steel boilers. The dredging pump is of the most massive and powerful description, to withstand the shocks which may be sustained when dredging in clay mixed with stones. The suction pipe is carried on a girder led through a well forward, and is of sufficient length to enable dredging to be done at a depth of 65 ft. below water-line. The dredger has also been designed for cutting its own flotation. The cutter at the mouth of suction pipe is driven through a line of shafting, fitted on upper side of suction frame, and machine-cut steel gearing, actuated by a set of powerful independent compound condensing engines. In addition to the usual winches for mooring from the deck at bow and stern, a special winch is placed amidship, from which the moorings are led along the suction frame to fairleads at lower end. The hopper is fitted with "Simons" patent arrangements, whereby the contents of the hopper can be discharged either through the doors in the ordinary way, or overside by the pump for land reclamation. In addition to loading into its own hopper, the vessel is arranged to discharge into barges moored alongside, or through a pipe line. Two sets of triple-expansion surface-condensing engines are fitted aft for propelling the vessel at a speed of 10 knots per hour. The auxiliary machinery in the propelling engine-room is of the most up-to-date character. The dredger has been built under special survey by Lloyd's and to their full requirements.

Intaba.—On Sept. 6th, this ship, built by Messrs. Hall, Russell & Co., of Aberdeen, to the order of Messrs. John T. Rennie, Son & Co., of London and Aberdeen, was successfully launched by the builders. She is 401 ft. long, 48 ft. 6 in. beam, and 30 ft. 8 in. deep, 4,700 tons registered, built on the Isherwood system, will hold Board of Trade passenger certificate, and is constructed in excess of Lloyd's highest requirements for scantlings. She is fitted out for about 130 passengers and sixty crew, having state-rooms and saloons and other accommodation both amidships and aft ; is fitted out in the most modern style with all conveniences and comfort. Her Marconi system will be of the new long-distance type. All her cargo fittings and arrangements are suitable for working heavy cargoes up to 25 ton lifts. The machinery has been constructed under the superintendence of Messrs. Flannery, Baggallay & Johnson, Ltd., of London, Liverpool and Rotterdam, consulting engineers to the owners. The engines have cylinders 27½ in., 45½ in., and 75 in. diameter by 48 in. stroke, supplied with steam from six large boilers and capable of developing about 3,000 I.H.P., with all the most modern arrangements of auxiliary machinery, such as See's ash ejectors, steam ash hoists, filters, feed heaters, freezing machinery, electric light and ventilating power, steam-steering gear right aft, auxiliary condensers and other arrangements for passengers' comfort and quick handling of the ship. Messrs. Wailes, Dove & Co.'s "Bitumastic" Enamel was applied to the athwartship and 'tween deck bunkers.

Luceric.—On Sept. 6th, there was launched at Port Glasgow a shelter-deck steamer, which has been built to the order of Messrs. Andrew Weir & Co., Glasgow and London. The vessel, which is designed for her owners' Pacific trade, is of the following dimensions :—Length, 480 feet ; breadth, 57 feet ; depth, 31 feet 6 inches ; with a gross tonnage of about 7,000. The vessel, which was named *Luceric*, was towed to Greenock to have her machinery fitted. Messrs. Wailes, Dove & Co.'s bitumastic enamel was applied to the boiler-room tank, deep tank and bunkers, and their bitumastic covering to the tank top in the boiler-room.

Abhona.—On Sept. 6th, Messrs. Alex. Stephen & Sons, Ltd., Linthouse, launched the steamer *Abhona*, the first of three twin-screw vessels now under construction by them for the British India Steam Navigation Co., Ltd. The *Abhona* is one of a number of vessels of varying type at present building for that Company's Indian Coastal service. She is one of the fastest class, with superior accommodation, and is 403 ft. in length, 50 ft. in breadth, and 33 ft. in depth. She has three complete decks, with bridge and boat decks above, and has accommodation for fifty first-class and fifty second-class, both classes being equally well fitted up. Special provision has also been made for native passengers, two complete decks being reserved for their use, as it is anticipated that over 3,000 will be carried each voyage during the busy seasons. The propelling machinery consists of two sets of quadruple-expansion engines, with two double-ended and four single-ended boilers, all constructed at Linthouse. Messrs. Wailes, Dove & Co.'s "Bitumastic" Covering was applied to the tank top in boiler-room, and their "Bitumastic" Enamel to the boiler-room tank and bunkers.

Loch Leven.—On Sept. 7th, there was launched at Bowling a steel screw steamer of 340 tons, which has been built to the order of Mr. John G. Stewart, Glasgow. The vessel, which was named *Loch Leven*, is to be fitted with compound engines.

Szent Isvant.—On Sept. 8th, the Clyde Shipbuilding and Engineering Co., Ltd., Port Glasgow, launched a steel screw steamer, 345 ft. by 45 ft. 6 in. by 25 ft. 2 in., for The Royal Hungarian Sea Navigation Co., 'Adria,' Ltd., Fiume, which,

during construction, was superintended by Alexander Rolland, Esq. The vessel was named *Szent Isvant* by Miss Welch, Clunebank, and immediately after the launch, was placed in the Company's dock to receive her machinery, which has also been constructed by the builders. Messrs. Wailes, Dove & Co.'s "Bitumastic" Enamel was applied to engine and boiler room tanks bunkers, fore and aft peaks and ship's sides in boiler-room and bilges, and their "Bitumastic" Covering to tank top in boiler-room.

LAUNCH—Irish.

Æneas.—On Aug. 23rd, Messrs. Workman, Clark & Co., Ltd., launched from their North Yard the new liner *Æneas*, built to the order of the Ocean Steamship Co., of Liverpool. The *Æneas* has been specially designed for passenger service, and for the carriage of refrigerated and general cargo between Great Britain and Australia. She is a twin-screw vessel, having a displacement of 19,500 tons, her principal dimensions being :—Length overall, 509 ft. ; moulded breadth, 60 ft. ; and moulded depth, 40 ft. She has five decks, the promenade, centrecastle, upper, main and lower decks, with excellent accommodation for about 300 passengers in commodious and airy two, three and four-berth cabins. The cabins on the centrecastle deck are each lighted and ventilated from the ship's side, and every consideration in the design of the vessel generally has been given to the comfort and convenience of the passengers. The dining saloon is on the second deck, and is tastefully decorated with oak dado and panels in French grey. The apartment is roomy and well lighted, a special feature being the central lighting well, which rises through two decks and is surmounted by a handsome stained-glass skylight. A series of handsome oak staircases lead from the dining saloon to the main entrance hall on the centrecastle deck. At the after end of this entrance hall is the music room. The smoke-room is also on this deck, but further aft, and is well lighted by side windows and a stained-glass skylight. A large nursery for the use of children is tastefully furnished and decorated in oak with white panels, a number of the panels being adorned with paintings illustrative of favourite nursery tales and rhymes. The *Æneas* is lighted throughout by electricity, and efficient ventilation, by means of electrically-driven fans, is provided in all the public rooms. Provision has also been made for the comfort of passengers when the vessel is in the northern latitudes, the heating of the vessel being effected by an excellent system of steam pipes and radiators throughout the accommodation. The steamer is fitted complete with all the most modern appliances for ensuring the safety of the ship and the utmost comfort of her passengers, while an installation of the wireless telegraph will enable the vessel to keep in constant communication with passing vessels and the shore. Being designed for the Australian trade, one of the holds and the after 'tween decks have been insulated and fitted up for the carriage of frozen meat and dairy produce and fruit. The refrigerating plant for the preservation of this cargo and the perishable stores is on the CO_2 or carbonic anhydride system, and the cooling effect is transmitted to the holds by means of brine-circulating pipes arranged in coils. The sanitary arrangements are of the most modern character, while the galleys and pantries are furnished with the latest type of culinary appliances. A laundry is also fitted on the ship with up-to-date machinery, by means of which the passengers can have their orders carefully attended to, an important consideration on a long voyage, while a hairdresser's shop, with an experienced attendant in charge, is also provided. The cargo space of the vessel is divided by watertight bulkheads into six large holds, which, by the adoption of the girder system of construction, are free of obstruction, and are capable of receiving the largest type of consignment, such as motor-cars, boilers, locomotives and general machinery. The hatchways to these holds have been constructed as large as possible with a view to the admission of the above, and are each equipped with two or three steam winches of the most powerful type, and the necessary derricks, one of which is capable of dealing with weights up to forty tons. The *Æneas* is propelled by two sets of triple-expansion engines, constructed by Messrs. Workman, Clark & Co., Ltd., the separate parts having been carefully designed and balanced to reduce vibration to a minimum. In addition to the main engines, the engine-room staff have under their charge a complete installation of auxiliary machinery, the electric light machinery and the refrigerating and icemaking plant. The engine-room has a large and roomy appearance and is well lighted and ventilated. Steam is supplied by three large double-ended steel boilers, of the cylindrical multi-tubular type, working under an improved system of forced draught. The stokeholds are provided with ash ejector and steam ash hoists.

FOREIGN LAUNCH.

Ymer.—On September 17th, Messrs. The Laxevaags Engineering and Shipbuilding Co., Bergen, Norway, launched the s.s. *Ymer*, built to the order of Messrs. J. Lund & Co., Bergen. The principal dimensions are :—Length overall, 239 ft. 6 in. ; breadth, 35 ft. ; depth moulded, 16 ft. 10 in. The machinery is also built by the Laxevaags Co., the cylinders being 16½ in. by 27 in. by 44 in. by 30 in. stroke. The working pressure is 175 lbs. per square inch.

TRIAL TRIPS.

Towneley.—On August 9th, the new steel screw steamer *Towneley*, built by Messrs. Wood, Skinner & Co. (Limited), Bill Quay-on-Tyne, to the order of the Burnett Steamship Company (Limited), Newcastle, left the Tyne for her official trial trip off Whitley Bay. The vessel, which is of the most up-to-date description, is of the long raised quarter-deck type, with long bridge and topgallant forecastle, having specially large self-trimming hatches, and fitted with all the latest appliances and improvements, especially with regard to deck machinery. The propelling machinery, which has been constructed by the North-Eastern Marine Engineering Company (Limited), Wallsend and Sunderland, at their Northumberland Engine Works, consists of a set of their latest type of triple-expansion engines, having cylinders 21½ in., 35 in., 58 in., by 39 in. stroke, steam being supplied by two large steel boilers, working at a pressure of 180 lb. per square inch. During the run over the measured mile at Whitley a speed of 12 knots was attained, the engines working to the complete satisfaction of all concerned.

Darlington.—On August 9th, the s.s. *Darlington*, constructed by Messrs. Earle's Shipbuilding & Engineering Co., Ltd., Hull, for Messrs. Wilson and North-Eastern Railway Shipping Co., Ltd., was taken for her trial trip, when the mean result showed an indicated speed of over 15 knots. The owners were represented by Mr. W. S. Hide (Suptg. Engineer), Mr. Duguid (Naval Architects Department), and the builders by Mr. Somerscales (General Manager), and Mr. Tyacke (Assistant Manager). (See August issue for Launch.)

Steel Tug for Pernambuco.—Recently Mr. Edward Hayes' of Stony Stratford, sent for her trial trip a steel tug built for Pernambuco. The length of the vessel is 51 ft. ; her breadth is 11 ft. ; depth, 7 ft. 4 in. from keel to pilot deck ; draught about 4 ft. 6 in. ; skin plating of mild steel, ¼ in. and $\frac{3}{16}$ in. bare in thickness, steel frames 2 in. by 2 in. on bulkheads, 1¾ in. elsewhere. Four bulkheads are fitted and the floors are extra deep, to give strength in case of grounding and to minimise vibration. Foreward of the collision bulkheads is a cable locker, the remainder of the fore part of the boat is used as a cabin for the crew, and is provided with cupboards, lockers and a folding table of teak. Aft of the cabin between steel bulkheads is the machinery space. The main engine is a "Hayes" standard compound of open front type, having cylinders 8 and 16 by 10 in. stroke. The balanced crank shaft is of Siemens-Martin steel. Automatic lubrication and water service are both fitted. The air, circulating, feed and bilge pumps are worked off the low pressure crosshead with long rocking levers. The boiler is of the marine return-tube type, built under Lloyd's survey for 120 lbs. working pressure. A bilge ejector and an auxiliary feed pump are fitted in the engine-room. All the deck woodwork is of teak. The aft space is designed to sleep extra hands if required. A slip towing hook is mounted on a stout oak post and a towing bow is fitted. She is a duplicate of one recently supplied by Mr. Hayes to the British Admiralty.

Haworth.—On August 13th, the new screw steamer *Haworth*, built by Messrs. John Readhead & Sons, Ltd., West Docks, South Shields, to the order of the Gordon Steam Shipping Co., Ltd., London, was taken to sea on her official trial trip. The vessel is of the improved single-deck type, with large holds, clear of beams and other obstructions in stowing cargo, and is of the following dimensions :—Length over all, 333 ft. by 48 ft. beam by 23 ft. 10 in. depth moulded, and carries a large cargo on a light draught of water. There is a long bridge amidships extending beyond the engine and boiler space, and on which are situated the steel deck houses, containing the cabins for captain, officers, engineers and apprentices, over which again are placed the steel chart and wheel houses, pilot bridge, etc. A topgallant forecastle contains the accommodation for crew, firemen, etc. The arrangements for loading and discharging of cargo are full and complete, there being seven powerful steam winches to work the nine derricks which feed large hatchways into the holds. Steam is supplied from a large multitubular donkey boiler of marine type. Shifting boards and feeders are also fitted throughout for carrying grain cargoes, and a large quantity of water ballast is carried throughout the double bottom and also in the after peak. The vessel is fitted with triple-expansion engines, also constructed by Messrs. John Readhead & Sons, Ltd., having cylinders 23½ in., 39 in. and 64 in. diameter by 42 in. stroke, steam being obtained from two large boilers of 180 lbs. pressure. The vessel is built to Lloyd's highest class and to their special survey. The trial was in every way satisfactory to all concerned.

Highland Scot.—On August 14th, the *Highland Scot*, the latest addition to the Nelson fleet of steamers, underwent very satisfactory trials on the Clyde. The trials consisted of four runs on the measured mile, and a run between the Cloch and Cumbrae. Everything was satisfactory, and the contract speed was exceeded by 1½ knots. See July issue for Launch.

Bluebell.—On August 16th, the first of the two new passenger ferry steamers, built by Messrs. Cammell, Laird and Co., Ltd., at their Birkenhead Yard, to the order of the Wallasey Urban District Council, went down the Mersey on her official trials, after being fitted with her machinery, which has been supplied by the shipbuilders. The trial trip proved in every way highly satisfactory, the engines working smoothly and with a very little vibration. A mean speed of nearly 12 knots was attained over the measured mile. See August issue for Launch.

Corbridge.—On August 11th, the trial trip took place of the s.s. *Corbridge*, built by Messrs. Robert Thompson and Sons, Ltd., of Southwick Yard, Sunderland, to the order of the Corbridge Steamship Co., Ltd. (Messrs James Hoggarth and Co., managers), of Cardiff, the second vessel they have built for the same management. The trial was in every way successful, and Captain Hoggarth and Mr N. T. Daniel, who were on board, expressed entire satisfaction with both vessel and engines. For Launch see September issue.

Brittany.—On August 12th, the s.s. *Brittany*, the second of two steamers constructed by Messrs. Earle's Shipbuilding and Engineering Co., Ltd., Hull, for the London, Brighton and South Coast Railway Co., was taken for her trial trip, when the mean speed on the measured mile was three-quarters of a knot in excess of the contract. The engines worked smoothly throughout the whole of the trial and the boilers supplied ample steam. After the measured mile runs the ship was taken to sea for a further test of the machinery and a consumption trial was made, the results of both tests being highly satisfactory. For Launch, see September issue.

Benpark.—On August 13th, the finely modelled steel screw steamer *Benpark*, built by Messrs. Craig, Taylor & Co., Ltd., Stockton-on-Tees, to the order of Joseph Holt, Esq., of Liverpool, underwent her trial, which proved highly satisfactory in every way. A speed of 10 knots loaded was obtained. A light trial trip speed of 12¼ knots was averaged, running each way over a six-mile course. For Launch, see September issue.

Thistletor.—On August 13th, the s.s. *Thistletor*, built to the order of Messrs. Allan, Black & Co. (Messrs. The Albyn Line, Ltd.), Sunderland, by Messrs. Irvine's Shipbuilding and Dry Docks Co., Ltd., West Hartlepool, proceeded on her official trial trip in Hartlepool Bay, after adjusting compasses. The whole of the main and auxiliary machinery worked most efficiently throughout the trials, a speed of 12 knots being obtained and the trial trip was in every way satisfactory. The engines and boilers have been supplied by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, the sizes of the cylinders being 25 in., 40 in., 68 in. by 48 in. stroke with two large single-ended boilers working at 180 lbs. pressure. For Launch, see September issue.

Anglo-Patagonian.—On August 17th, the s.s. *Anglo-Patagonian*, lately launched by Messrs. Short Brothers, Ltd., Sunderland, left the Tyne for fully loaded trials. Every attention has been given by the engine builders to the question of economy and it is expected she will average a speed of 10½ knots on about 28 tons per day. Several trial runs were taken, during which the machinery worked to the satisfaction of all on board and a mean speed of 11 knots was maintained. After the trial the vessel proceeded on her voyage to Valparaiso, under the command of Captain Lewis. For Launch, see July issue.

Pakeha.—On August 20th, the *Pakeha*, a new steamer of about 8000 tons gross register, built by Messrs. Harland and Wolff, Ltd., to the order of Messrs. Shaw, Savill and Albion Co., Ltd., for the New Zealand trade, left Belfast Harbour, and after adjustment of compasses and trials proceeded to the Tyne for dry-docking and coaling. Captain R. J. Noal, marine superintendent, and Mr. George Adams, superintendent engineer, joined the vessel at Belfast, and Captain Joseph Maxwell, one of the most experienced officers in the service, is in command of the ship. For Launch, see July issue.

Kendal Castle.—Recently the s.s. *Kendal Castle*, lately launched by Messrs. Short Brothers, Ltd., from their shipbuilding yard at Pallion, Sunderland, to the order of Messrs. James Chambers & Co., for the Kendal Castle Shipping Co., Ltd., of Liverpool, underwent her trials off the port. Several runs along the measured mile were taken and a mean speed of 11½ knots was easily maintained, the engines working smoothly, and although only having bunkers on board, the total absence of vibration was very marked. Mr. Joseph Short represented the builders. After the trial the vessel proceeded to the Bristol Channel to load, under the command of Captain Dash. For Launch, see September issue.

Lingfield.—On August 24th, the s.s. *Lingfield*, built to the order of Messrs. Woods, Tyler & Brown (The Woodfield S.S. Co., Ltd.), London, by Messrs. Irvine's Shipbuilding and Dry Docks Co., Ltd., West Hartlepool, proceeded on her official trial trip in Hartlepool Bay after adjusting compasses. The trial trip was in every way satisfactory, a mean speed of 13 knots being easily maintained on the measured mile. The hull and engines have been constructed under the supervision of Captain McFee and Mr. J. W. Collins respectively, and both of these gentlemen accompanied the vessel on the trial trip, after which she proceeded to the Tyne to load. For Launch, see September issue. A Cochran (Annan) donkey boiler, with patent seamless furnace, has been supplied and fitted.

Dalecrest.—On August 26th, the finely-modelled steel screw steamer *Dalecrest*, built by the Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne, to the order of Messrs. Taylor & Worthington, Liverpool, for Messrs. The Dalecrest Steamship Co., Ltd., Liverpool, left the Tyne to undergo her official trial trip. The trip proved in every way satisfactory and a speed of 11¾ knots was easily obtained. After the trial trip the vessel was taken to Tyne Dock for bunker and then proceeded to Antwerp to load for the River Plate. For Launch, see September issue.

Marengo.—On August 31st, the fine steel screw steamer *Marengo*, which has been constructed by Messrs. The Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne, to the order of Messrs. Thos. Wilson, Sons & Co., Ltd., Hull, for their North Atlantic trade, left the Tyne for her trial trip. The trip proved in every way satisfactory, and a speed of 13 knots was easily obtained. After the trial trip the steamer sailed for Hull, under the command of Captain Owen. For Launch, see July issue.

Boyne.—Recently this handsomely modelled and highly-finished steamer left the Wear to undergo her official trial trip. She has been constructed by Messrs. Joseph L. Thompson & Sons, Ltd., of the North Sands Shipbuilding Yard, Sunderland, to the order of Messrs. The Mercantile Steamship Co., Ltd., of London, and is the thirteenth vessel Messrs. Thompson have built for this Company. The trip was most successful in every way, and a speed of 12½ knots was easily maintained, the engines and auxiliaries working very smoothly and giving complete satisfaction to all on board. There were present on board Captain A. C. Cooke, secretary to the owning Company, and Mr. S. H. Watson, under whose supervision the ship and engines were constructed; Mr. Shepherd, of Messrs. Blair & Co., Ltd., and Mr. R. Norman Thompson representing the builders. For Launch, see August issue.

Kamma.—On August 31st, the new steel screw steamer *Kamma*, built by Messrs. Wood, Skinner & Co., Ltd., Bill Quay-on-Tyne, to the order of Mr. Martin Carl, of Copenhagen, left the Tyne for her official trial trip. During the trial run the machinery worked very satisfactorily, a mean speed of over 10 knots being easily maintained. Amongst those present were Mr. A. Matzen, representing the owner, Mr. J. Skinner and Mr. Leslie Skinner representing the shipbuilders, and Mr. H. Luhrs representing the engine builders. For Launch, see September issue.

Fridland.—On September 3rd, the handsome steel screw steamer *Fridland*, built by Messrs. Wm. Gray & Co., Ltd., for Messrs. Axel Brostrom & Son, of Goteborg, was taken for her trial trip. The hull and machinery have been constructed under the supervision of Mr. Filip Landahl, assisted by Mr. C. A. Olsson and Mr. D. Bore. The two former gentlemen represented the owners on the trial, Captain J. E. Burrell represented the builders of the ship, and Mr. Maurice S. Gibb the engine builders. A speed of 12½ knots was maintained, the performance of ship and machinery being highly satisfactory. For Launch, see August issue.

BOARD OF TRADE EXAMINATIONS.

1910. Extra First Class.

Aug.	4th—Briggs, E. E.	Ex 1C	N.Shields
,,	4th—Earnshaw, W.	Ex 1C	N Shields
,,	4th—Hemy, H. W.	Ex 1C	W.Hart'l
,,	4th—Hurworth, J. P.	Ex 1C	W. Hart'l
,,	4th—Mackenzie, H.	Ex 1C	London
,,	4th—Skelton, H.	Ex 1C	London
,,	4th—Stephens, E. R.	Ex 1C	London
,,	4th—Vickerman, E G. ..	Ex 1C	Hull

NOTE—1C denotes First Class: 2C Second Class.

June 23rd.

Baile, H. E. ..	2C	Liverpool
Blood, W. H. ..	1C	Liverpool
Booth, Wm. ..	1C	N Shields
Bowen, W. J. ..	2C	Cardiff
Brimer, I.	2C	Cardiff
Brown, H. P. ..	2C	Cardiff
Buchan, R.	1C	Glasgow
Cransfield, J. ..	1C	W.Hart'l
Davis, M. S. ..	2C	Glasgow
Fishers, C.	2C	South'ton
Gibson, J. J. ..	2C	Liverpool
Hendry, T. N.	2C	Liverpool
Irvine, Geo. ..	2C	Glasgow
Jackson, J.	1C	Glasgow
Jenkins, T. R. ..	1C	Cardiff
Lawson, V. O.	1C	Cardiff
Liddicoat, W. J.	1C	Plymouth
Lofthouse, M.H.	1C	Glasgow
Macaulay, J. H.	1C	Glasgow
Mallaby, A. P.	2C	W.Hart'l
McEwan, J. ..	2C	Liverpool
McKinlay, C. ..	2C	W.Hart'l
M'Millan, P. G.	1C	Glasgow
M'Naught, G.C.	2C	Glasgow
Morley, R.D.R.	2C	N.Shields
Murphy J. C. ..	1C	Cork
Neil, A. M.	2C	Glasgow
Orchard, C.....	1C	Cardiff
Peters, J. G. ..	2C	Cardiff
Phillips, E.	2C	Cardiff
Pope, E. D. S.	2C	N Shields
Price, D. X. ..	2C	Cardiff
Robb, M.....	2C	Leith
Robertson, J. ..	2C	Glasgow
Ronchetti, J. W.	1C	W. Hart'l
Rutherford, E.T.	1C	London
Savage, W. H.	2C	Liverpool
Sparkes, J J...	1C	N.Shields
Sparling, J. C.	1C	London
Spottiswood, H.	2C	Glasgow
Stephenson, A R.	2C	Cardiff
Steven, W.	1C	Glasgow
Straker, A. T...	1C	N.Shields
Taylor, J. A. ..	1C	Liverpool
Thomson, C. ..	1C	London
Thomson, J. W.	1C	N.Shields
Thomson, W. ..	1C	N.Shields
Thubrun, T. J.	1C	N.Shields
Tregenza, C. ..	2C	Liverpool
Turner, A.	2C	South'ton
Walker, M.....	1C	N.Shields
Wallet, T.	2C	Glasgow
Wallis, E. H...	2C	South'ton
Watt, G. W. ..	1C	Glasgow
Williams, R. L.	1C	Liverpool
Winstanley, H.	1C	Liverpool
Wood, R. S. ..	2C	Cardiff

June 30th.

Adam, John W.	2C	Aberdeen
Bamford, E. P.	1C	London
Bartlett, R. D.	2C	Hull
Beszant, Horace	2C	Bristol
Burlinson, A. H.	2C	Sunderl'd
Cadger, Charles	2C	Aberdeen
Campbell, G. E.	2C	Sunderl'd
Christy, Percy	1C	Sunderl'd
Cook, Frank ..	1C	Hull
Cousins, Alex.	2C	Greenock
Crawford, J. ..	2C	Greenock
Currie, Alex. ..	1C	Greenock
Gallie, Thomas	2C	Greenock
Giles, G. W. ..	2C	Hull
Greenlees, F. ..	2C	Sunderl'd
Gresswell, G. J.	1C	Hull
Griffiths, R. B.	2C	Liverpool
Gray, John S...	1C	London
Hadland, Victor	1C	Hull
Hannah, W. A.	1C	Liverpool
Hunt, G. A. ..	2C	Liverpool
Jackson, J. F...	2C	London
London, Arthur	2C	Liverpool
Mackay, M. ..	1C	Liverpool
Masson, J. W.	2C	Aberdeen
M'Donald, W. J.	1C	Aberdeen
Metcalf, J. C...	2C	Sunderl'd
Miller, Robert	1C	Greenock
Mitchell, J. L.	1C	London
McPhail, A. ..	1C	Greenock
Morrice, D.M.B.	1C	Greenock
Owens, D. J. ..	2C	Liverpool
Patrick, A... ..	2C	London
Pimblott, David	2C	Liverpool
Reid, A. R.....	1C	Aberdeen
Ritchie, W. S..	1C	Aberdeen
Ross, Stuart P.	2C	Bristol
Smith, Peter H.	2C	Sunderl'd
Stuart, G. J. ..	1C	Hull
Taylor, Henry	2C	Sunderl'd
Tomlinson, L.T.	1C	London
Turner, A. E...	2C	Bristol
Walker, J. L...	1C	Liverpool
Weir, John	1C	Greenock
Wilson, P. H.	1C	Liverpool
Winsor, P. F.	1C	Hull

July 7th.

Aitken, J.....	1C	Leith
Allsopp, W. J.	2C	Liverpool
Amey, A. G. ..	2C	Liverpool
Briggs, W. J. ..	2C	London
Blaney, N.	2C	Belfast
Bond, A.W. ..	1C	South'ton
Campbell, J. M.	1C	Cardiff
Clark, J. McL.	1C	N.Shields
Clother, L.	1C	London
Davidson, T. A.	2C	Liverpool
Deeks, P. J.....	1C	South'ton
Durrant, E. C.	2C	N Shields
Farthing, N. H.	1C	N.Shields
Fooks, H. W...	2C	South'ton
Foxall, J.	1C	N.Shields
Hardie, A. G...	2C	Liverpool
Higgins, B.	1C	Glasgow
Howson, A.	2C	Cardiff
Hughes, D. G.	2C	Cardiff
Hunt, D H. ..	2C	Cardiff
Ireland, A.	2C	Liverpool
Johns, H.....	2C	Cardiff
Lang, G. H. D.	1C	London
Macdonald, J.	2C	N.Shields
Mays, W. H. ..	2C	Liverpool
Matthews, W.	2C	N.Shields
M'Connell, R.	2C	Glasgow
Metcalfe, H. ..	1C	N.Shields
Morgan, H. T.	2C	Liverpool
McPherson, R.	2C	Glasgow
Nelson, W. R.	2C	Leith
Nicoll, J. B. ..	2C	Liverpool
Paradise, C. F.	2C	Cardiff
Paterson, W. ..	2C	Cardiff
Scorer, J.....	2C	N.Shields
Sharp, J.....	2C	Leith
Simon, H. W.	2C	Liverpool
Skyrme, A.	1C	Cardiff
Smith, T. J. ..	2C	London
Spedding, W J.	2C	Liverpool
Spence, R.	1C	N.Shields
Sutherland, C.	2C	Leith
Sutherns, H. ..	2C	Cardiff
Tweedie, A	1C	Glasgow
Walker, J. M...	2C	Leith
Webb, W. T. ..	2C	London

July 14th

Adam, K. H. ..	1C	Liverpool
Austin, J. T. ..	1C	Greenock
Brown, D.	1C	Greenock
Buchanan, J. ..	1C	Liverpool
Callister, W. ..	1C	Liverpool
Chappell, E. J.	2C	N Shields
Coppinger, C. W	2C	London
Cowie, J.	1C	Greenoc
Dayles, A.	1C	London
Dougall, G. N.	1C	Liverpool
Douthwaite, A.	1C	N.Shields
Ferguson, J. J.	1C	N.Shields
Griffith, W.	2C	Liverpool
Kennedy, F. S.	1C	N.Shields
Lancaster, O. ..	2C	Liverpool
Lowson, G. L.	1C	Dundee
Marsh, G. R. ..	2C	N.Shields
Martin, J. W...	2C	Hull
Matthew, G. A.	1C	Dundee
McGillivray, M.	2C	N.Shields
McLean. N. A.	1C	London
Montgomery, D.	1C	Greenock
Morgan, J.	1C	Greenock
Morrison, J. ..	1C	Greenock
Myers, L.	1C	Hull
Nicholas, W. R.	1C	London
Philip, W. J. ..	1C	London
Rance, W. O. P.	2C	London
Ritchie, G. L. ..	2C	Dundee
Scott, J.	2C	Liverpool
Stewart, R.	1C	Greenock
Thomas, A. W.	2C	N. Shields
Topham, W. M.	2C	Hull
Wadsworth, H.	1C	Greenock
Waller, C. J. ..	2C	Liverpool

July 28th.

Alexander, J. A.	2C	Greenock
Barron, W. ..	2C	Aberdeen
Booth, W. H...	1C	Sunderl'd
Boyce, R.....	2C	Aberdeen
Brown, J.....	2C	Aberdeen
Buckton, C. N.	1C	N.Shields
Butler, F. J. ..	2C	Liverpool
Buxton, S.	2C	Liverpool
Christian, G. ..	2C	Hull
Cram, P. J.....	1C	Liverpool
Ellis, A. P. ..	2C	N.Shields
Evans, A. R. ..	2C	Bristol
Garrett, R. A...	2C	London
Girvan, J. S. ..	2C	Greenock
Johnson, A.....	2C	N.Shields
Jones, C.	2C	Liverpool
Jones, J. T. P.	1C	Liverpool
Kirkham, J. A.	1C	Liverpool
Latham, R. J...	1C	Liverpool
Liddell, S. C...	2C	N.Shields
Mack, J. W....	1C	Liverpool
Mason, G. W...	2C	N.Shields
M'Donald, J A.	2C	Greenock
Mitchell, E. P.	1C	Greenock
Meffet, J. E. ..	2C	N.Shields
Mendham, S. E.	1C	N.Shields
Morrisson, J.W.	1C	Aberdeen
Mossman, H. ..	2C	Liverpool
Nicol, E. J.....	2C	Greenock
Peacock, W. ..	2C	Sunderl'd
Penney, R. E.	1C	London
Richards, E. .	1C	Bristol
Roberts, J. E...	2C	Liverpool

Simpson, D. ..	1C	London
Slater, N.	1C	Bristol
Stephens, J. L	1C	London
Sugden, A. F...	2C	London
Swan, R. F. ..	2C	Sunderl'd
Terviel, J. A. ..	2C	N'Shields
Vick, E. E.	2C	London
Waddell, J. O.	2C	N.Shields
Watt, J. H.....	2C	Greenock
Whitton, G. C.	2C	Liverpool
Wilson, H. C.	1C	N.Shields

August 4th.

Alchin, S. A. ..	2C	Cardiff
Atkinson, J. ..	2C	Liverpool
Bain, E.	1C	N.Shields
Bate, L. C.	1C	Cardiff
Blair, D. M. ..	1C	Glasgow
Brown, D.	2C	London
Butterworth, G.	1C	Liverpool
Carey, R.....	1C	Cardiff
Carnie, J.....	1C	Glasgow
Clarke, E. J. ..	2C	London
Colley, F.	2C	London
Cook, J. W. ..	2C	N.Shields
Cowan, A.	1C	Glasgow
Crossman, W.H.	2C	Cardiff
Edwards, H. ..	2C	Liverpool
Gold, R	1C	Glasgow
Gray, A. F.....	2C	Leith
Green, V. H. ..	2C	Liverpool
Harrington, C.M.	2C	Cardiff
Harvey, S. R.	2C	Liverpool
Hermans, S. ..	2C	Liverpool
Higgitt, W. H.	1C	London
Horsburgh, D.	2C	Liverpool
Jones, J. H.....	2C	Cardiff
Knowles, T.....	2C	N.Shields
Le Sueer, L. ..	1C	London
Mackay, J. D...	2C	Glasgow
MacSwiney, F.E.	1C	Liverpool
Martin, E.	2C	N.Shields
McLean, A. S.	2C	Glasgow
McLennan, J...	2C	Glasgow
Morcuts, G.....	2C	Cardiff
Myles, M J. ..	2C	Liverpool
Neild, J.	2C	Liverpool
Nelson, J.....	2C	Glasgow
Parson, J. H. ..	1C	Glasgow
Prichard, J. L.	2C	Liverpool
Priestley, C. G.	1C	Cardiff
Pritchard, G. H.	1C	Cardiff
Riddock, C. H.	1C	Liverpool
Roberts, W. T.	2C	London
Scott, J. W.....	2C	N.Shields
Smith, E. T. V.	2C	South'ton
Walker, J. J. ..	2C	N.Shields
Weatherill, E.T.	2C	Liverpool
Williams, E. P.	1C	N.Shields

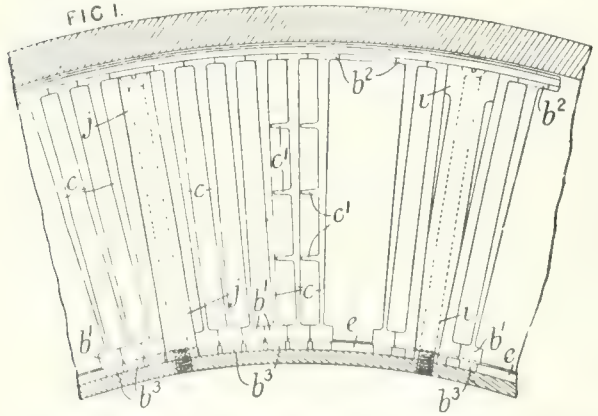
August 11th.

Adams, F. J. ..	1C	Dundee
Batchelor, R. O.	2C	Liverpool
Black, A.	2C	Dundee
Boyd, C	2C	N.Shields
Brown, G	2C	Greenock
Carson, D. C...	2C	Hull
Finn, T. H.	1C	Liverpool
Freeman, R. ..	2C	London
Hepworth, E.C.	1C	London
Laird, W. B. ..	2C	N.Shields
Lees, G. F.	2C	Liverpool
Lumsden, J. T.	1C	Greenock
Mollison, J. ..	1C	Dundee
Morrison, J. J.	1C	Liverpool
Nicholson, D.H.	2C	N Shields
Phiampolis, P.	2C	N Shields
Pidgeon, R. C.	2C	N.Shields
Purves, A.	1C	N.Shields
Ryan, J. T.....	1C	London
Smith, L. J. ..	1C	London
Stephenson, T.	1C	N Shields
Steven, W.	1C	Greenock
Taylor, S. R. ..	1C	N.Shields
Thorburn, W.L.	1C	Greenock
Windebank, T.H.	2C	London

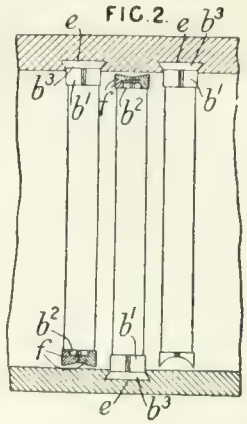
The Marine Engineer and Naval Architect Patent Record.

Compiled by Messrs E. P Alexander & Son, Chartered Patent Agents, 306, High Holborn, London, W.C.

No. 10,720. Turbines. Axial-flow turbine blades (*c*, Fig. 1) are made of wedge shaped cross section so that the width of the fluid passage way is constant from root to tip. The roots comprise distance-pieces (b^1, Figs. 1 and 2) and dovetail root portions (b^3), these fitting into an undercut

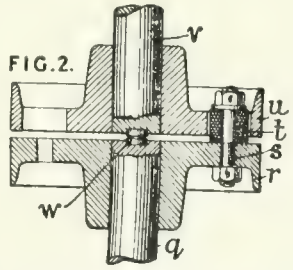


groove (g). The tips of the blades are formed with lateral portions (b^2) which, when the blades are assembled, form a



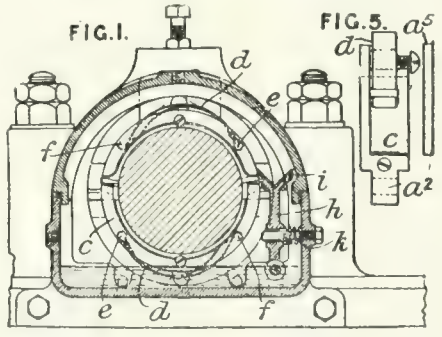
shroud. Alternatively, as shown in Fig. 2, the shroud may be composite, comprising the tips (b^2) and flanged rings (f). The parts (b^2, b^3) are formed with radial projections and notches to ensure correct engagement with their adjacent parts. A section of blades is caused to abut against a piece (j) screwed in position by the action of wedge (i) similarly screwed on. Long blades may be formed with lateral webs (c^1).

No. 10,926. Centrifugal Pumps. A balanced centrifugal pump and its driving-motor are arranged on a vertical shaft, and a yielding coupling of known type, as shown in Fig. 2, is used to transmit the weight of the motor, which is above the pump, to the balancing-device. Flanges (r, u) are secured



to the pump and motor shafts (q, v) respectively, and are coupled by bolts (s) fitted with a number of washers (t) of leather or like material. Bearing-discs (w), one of which is preferably convex, are provided. In a modification, a ball-ring is substituted for the discs.

No. 12,085. Lubricators. A lubricating-device for shaft bearings of the kind described in Specification No. 812, A.D. 1909, comprises a collar (c) of U-shaped section mounted on the shaft. To the periphery of the ring are attached two or more bow springs (d), from which adhering lubricant is removed by a transverse scraper (i) and delivered to a conduit



in the lower bearing-brass. The collar (c) is made in two parts connected by lugs (a^2, Fig. 5), and has a removable side plate (a^5). The springs (d) are fixed to cross studs (e) and pass loosely under other studs (f). Coiled springs and pivoted levers may be substituted for the bow springs. The lever (h) carrying the scraper (i) may be pressed by a spring (R) in the direction of the collar (c).

The Marine Engineer

And Naval Architect.

LONDON, NOVEMBER, 1910.

TURBINE-DRIVEN CARGO BOATS.

FROM the inception of the idea of the use of the modern steam turbine for ship propulsion, the question of the assimilation of the necessary high rate of revolution of turbine with the relatively low rate of the ordinary ship's propeller has occupied a prominent place in the thoughts of those who have been regarding the problem from a practical standpoint. We have in the past recorded the views and results of experiments of those who have dealt with the solution by means of mechanical, electrical and hydraulic gearing.

In our April issue we reprinted a paper by the Hon. C. A. Parsons on the application of the marine steam turbine and mechanical gearing to merchant ships, in which was included a description of a 10-H.P. turbine driving by single helical gearing the two shafts of a twin-screw launch 22 ft. long, which drove the launch when running 1,400 revolutions per minute about nine miles per hour. This launch was built in 1897, and after seven years' use was sent for overhaul, when it was found that the gear was in perfect order. In 1909 the directors of the Turbinia Works decided to test turbines mechanically geared to the screw-shaft of an existing typical slow-speed vessel, and a cargo vessel, the *Vespasian*, of 4,350 tons displacement, was purchased for this purpose and fitted with an ordinary triple-expansion surface-condensing engine of 1,000 I.H.P. when running at 70 revolutions per minute, which gave the ship a speed of 10¼ knots. After an extended trial under ordinary working conditions, during which careful measurements were taken from which the nett water consumption per horse-power-hour was shown to be 17 lbs., the reciprocating engine was removed and high and low-pressure turbines and helical gearing were substituted, the propelling machinery being left as it was. The ratio of the gearing was 19·9 to 1, and the results attained were as follows:—The revolutions of the propeller were 73 per minute, the speed of the ship 10·66 knots, the shaft horse-power 1,095, and the nett water consumption per horse-power-hour was 14·3 lbs. The geared turbines at ordinary sea-speeds reduced the steam consumption 15%, as compared with the consumption required for reciprocating engines. We note in the annual report of the company that since the above tests were carried out the vessel has been continuously employed on ordinary sea service carrying coals to Rotterdam and returning in water ballast. She has completed fourteen voyages, and steamed 8,500 miles in all weathers. The working of the machinery was quite satisfactory, and gave no trouble whatever, while there was a remarkable freedom from racing, even in the roughest weather. The results obtained in the earlier trials as to relative economy in steam consumption when compared with reciprocating engines have been confirmed by the data obtained on these voyages. From the results above given it may be reasonably assumed that the time is not far distant when the geared turbine will find extensive use in the very numerous and important class of cargo steamers of the British and other mercantile marines, by which the carrying trade of the world is principally performed. One can but admire the thorough and conclusive manner in which the Hon. C. A. Parsons tackles every problem presented to him, and the soundness of his conclusions is clearly demonstrated by the solid advance in the art made at each step in the progress of the particular matter in hand.

THE LAUNCH OF THE "OLYMPIC."

THOSE who were privileged, as we were, to be present at the launch of the *Olympic* last month, must have been struck at the simplicity of the proceedings and the absolute lack of any ceremonial in what must be admitted is a world record in a double sense. The *Olympic* is not only the largest vessel afloat, but as launched she represents the heaviest structure that has ever been moved under controlled conditions from land to water. We desire to congratulate Messrs. Ismay, Imrie & Co., the owners, and Messrs. Harland & Wolff, the builders, on the success thus far achieved in the production of this mammoth vessel. It will be remembered that the policy of the White Star Line has been to provide in their vessels every possible comfort and convenience for their passengers, but to keep their speed and consequent engine power within moderate limits. Although the *Mauretania* and *Lusitania* have a length of 760 feet between perpendiculars, 88 feet beam, and a displacement of 39,000 tons, and require 73,000 shaft H.P. to propel them 26 knots, the *Olympic* and her sister ship *Titanic* are 882 feet long, 92 feet 6 inch beam, and have a displacement of 66,000 tons, and will require only 46,000 H.P. to drive them at a speed of 21 knots. This difference alone indicates a distinct difference of economic principle involved in the two types of ship. We understand that in addition to much larger passenger accommodation the *Olympic* can take 6000 tons more cargo than the Cunarder, which in addition to the reduced fuel consumption must show a considerable credit item in a profit and loss statement. We do not in any way desire to disparage the enterprise of the Cunard Co., and it is well to point out

that the two huge Cunarders were built under special conditions for State reasons which do not obtain in regard to the White Star vessels. We have plenty of evidence that this last effort is by no means the last word in shipbuilding, as the New Hamburg American Liner is to be 940 feet long or nearly 60 feet longer than the *Olympic*, and is to have a speed of 22 knots. We cannot believe that the Cunard Company will allow matters to remain thus, and we shall be much surprised if time does not show that the suggested 1000 feet liner will within a short period become an accomplished fact. It will be interesting to watch the actual results of the *Olympic* in order to see how far the excellent performances of the *Laurentic* as to her combination will be equalled or excelled in the *Olympic* and *Titanic*. As showing the potentiality of the exhaust steam turbine, it is estimated that taking the steam at 9 lbs. absolute the turbine will develop more power than either of the sets of triple-expansion reciprocating engines, each of which is of 15,000 I.H.P. Looking back for a moment at the details of construction of such gigantic vessels, there are important matters of consideration to be dealt with apart from the vessels themselves, such, for example, as the outlay for special foundations and general handling equipment for material for construction, and in going over the shipyard at Belfast one is impressed with the idea that hundreds of thousands of pounds must have been sunk in permanent improvements, necessitated by the special circumstances, before the ship was even started on. The Irish firm can claim that nowhere in the world are there any slipways comparable with the two recently laid down for the White Star vessels.

MANCHESTER ASSOCIATION OF ENGINEERS.—On October the 22nd, Mr. D. Wilson, of London, read a paper before the Association on "Water-Tube Boilers."

ENGINEERS-IN-CHARGE.—Captain H. Riall Sankey gave his Presidential Address on October 19th. He chose for his subject "The Ordnance Survey and the Design and Use of Machinery for printing maps."

N.-E. C. INST. OF ENGINEERS AND SHIPBUILDERS.—The twenty-seventh annual meeting was held on October 28th. The Institution dinner will take place on December 6th at the Great Hall, Armstrong College, Newcastle-upon-Tyne.

LECTURES ON THE LAW RELATING TO ENGINEERING.—Lectures on the above subject will be given at Caxton Hall under the auspices of The Society of Engineers (Incorporated). The dates are November 9th and 21st, December 7th and 19th.

SHIPBUILDING DETAILS OF THE WORLD.—We take this opportunity to remind our readers that the January number of *The Marine Engineer and Naval Architect* will contain, as usual, the shipbuilding returns of the world, in addition to much other useful information.

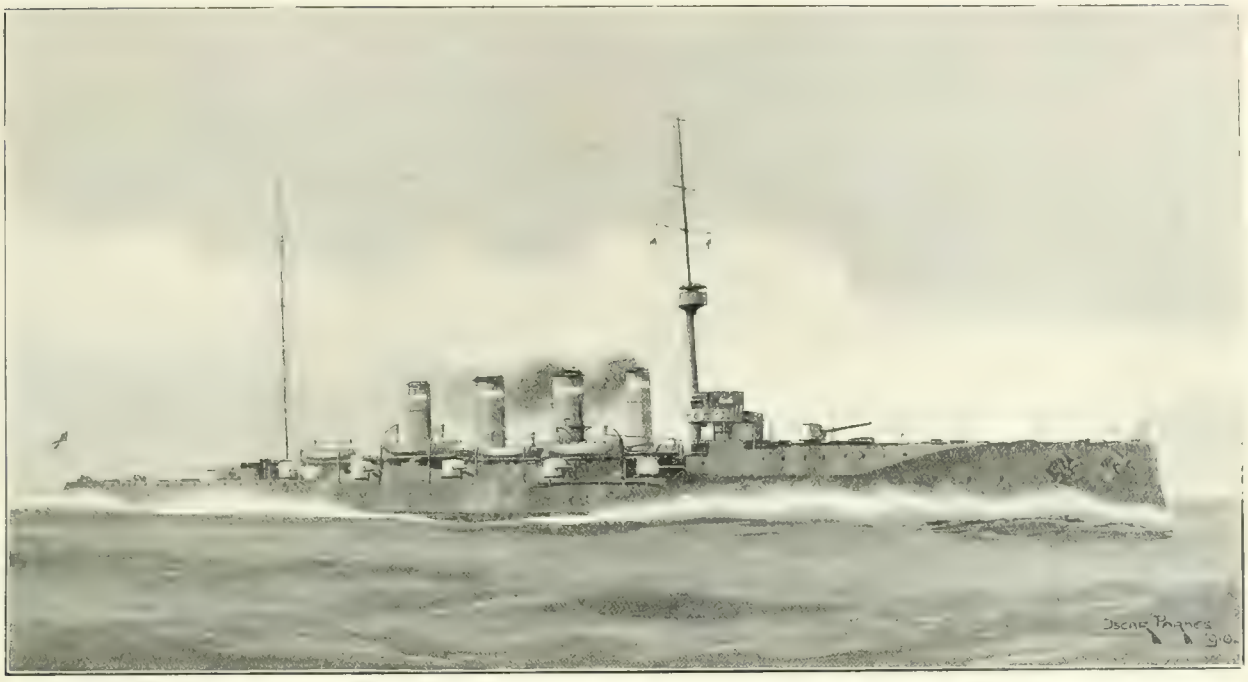
CARBONIC ACID GAS WORKS, GRAVESEND.—We note that a CO_2 factory has been established at Gravesend for the purpose of supplying gas to mineral-water manufacturers and for ships' use. There should be a good market in the district around Gravesend and Tilbury, and, as the management of the works is in experienced hands, doubtless the venture will be successful in catering for a large number of customers when the quality of the gas is realized to be superior.

NEW BRITISH AND GERMAN CRUISERS.

WHEN our last protected cruisers, the *Encounter* and *Challenger*, were launched, they were universally regarded as the final units of the type that would be constructed; the huge armoured ships of the *Good Hope* class filled the naval horizon so far as cruisers were concerned—just as we think in *Dreadnoughts* now—and no useful rôle could be discovered which could not be more efficiently filled by these great ships than by the small second-class cruiser. Construction of ships of smaller displacement than *circa* 10,000 tons was suspended indefinitely—for ever, according to most of the service papers of the period—and the great fleet of armoured cruisers of the *Country*, *Drake*, *Black Prince*, *Devonshire*, *Natal* and *Defence* classes came into being. But evolution demanded something still more powerful, and the next step upwards on the displacement ladder brought forth the 17,250 ton "Indomitables." But by then the necessity for the light cruiser had become evident. The 40 odd vessels of the Naval Defence Act and subsequent programmes were rapidly deteriorating and being passed out of service. The "Scouts" were failures as sea-keeping ships, owing to limited fuel supply, and consequently a shortage in small craft suitable for scouting, convoy, etc., arose. The *Bellona* and her sisters were officially known as "Mother" ships for destroyers, and their light 4″ armament greatly restricted their use as cruisers; as "Scouts" they are still being built, but the "Town" class mark the advent of the protected cruiser from a hasty consignment to oblivion, as "cruiser" pure and simple. Five are now being passed into service and four more are ready for launching, while provision for additional ships of the same general type is assumed in future estimates. So long as the average speed of the battleships was 17 to 18 knots, the smaller armoured cruisers could be told off for those fleet duties which the old protected cruisers were becoming too slow to perform. When, however, the armoured cruiser developed into a battleship in all but name, their absence from the fighting-line on duties which by right should be performed by the protected cruiser, so weakened the fleet that no admiral would risk absenting them from his battle fleet.

The "Town" class seem admirably fitted for all the manifold duties they will be called upon to perform. Upon a displacement of 4,800 tons they carry an armament of two 6″ and ten 4″ guns, together with two torpedo tubes. This, of course, is by no means an ideal offensive equipment, and the latest *Weymouth* class will carry eight 6″ guns instead of the dual calibres. The ships for all that will, in this respect, be superior to any similar craft at present under construction abroad.

With the exception of the *Bristol*, which has Curtis turbines, all the ships have Parsons machinery. Full data as to the results recorded on trial cannot be as yet obtained, but particulars are appended of the figures to hand at the time of writing. The comparison between the Curtis and Parsons forms of turbine will be of the greatest interest, there being no reliable



The *Liverpool*. British Cruiser.

The *Mainz*. German Cruiser.

data as yet upon which opinions as to which is the better system of propulsion can be based. It will be remembered that the starboard turbine of the U.S.S. *Salem*—which is fitted with Curtis—was found to be defective after the comparative trials between her and the Parsons *Chester* and reciprocating *Birmingham* had been run; this, however, was not known at the time, hence the results must be regarded as inconclusive.

No separate cruising turbines are fitted, as has been formerly the case (*Amethyst*), but there is an extension at the H.P. end of the turbines which can be used for low speeds only. There are two H.P. and L.P. turbines, one on each of the four shafts, and a similar arrangement of astern machinery. The designed horse-power is 22,000 (which has been considerably exceeded on trial), and speed 25 knots.

Turning to the German "opposite numbers," we find in the 4300 ton *Mainz* the result of steady development from an original displacement of 2,645 tons in the *Gazelle* class of 1898. Unlike ourselves, Germany never abandoned the small protected cruiser during the development of her armoured cruisers, but kept on laying down two or three per annum and gradually improving and increasing the displacement in subsequent classes. Tonnage has gone up from 2,645 to 4,300, speed from 21·6 to 28 knots (best recorded results) and armament from ten to twelve 4·1″ guns. Consequently, although the earlier ships are rapidly becoming worn out from the incessant work they have undergone, there are now some thirty-one units built and building of the same general type, which can perform the duties of our "Towns," owing to their adequate fuel accommodation (560 tons in the "Gazelles" to 1,000 tons in the *Mainz*).

The *Mainz* is one of four sisters of 4,300 tons, being 400 feet long over all, 43½ feet broad and drawing a maximum of 17¾ feet. The twelve 4·1″ pieces are carried as follows: two in the bows and stern and eight in the waist. Four five-pounders are mounted on the bridges, and there are two submerged torpedo tubes. As may be seen from the plan, a 2″ deck covers the vitals amidships and a ¾″ deck the ends. The conning tower forward is of 4″ steel. The *Mainz* has Curtis turbines, the *Kolberg* Schichau, the *Köln* Zoelly and the *Augsburg* Parsons. Unfortunately the competitive trials of these four types are not yet concluded, but full details will be given in these columns in due course.

In accordance with the laws of standardization so characteristic of the German Navy, Schulz-Thornycroft boilers have been fitted to all except the three earliest ships. Whether or no this type of steam generator is the best is not of such importance as the fact that a good reliable boiler has been installed in twenty-eight ships—and the Thornycroft in two more—an arrangement which facilitates speedy repairs and interchangeability, and minimises the instruction work of the engine-room staffs.

The designed H.P. of the *Mainz* is 20,000, which should have given a mean speed of 25·5 knots. On trial, however, this only worked out at 25 knots, although 27·5 and 28 knots had been recorded on the fastest runs.

It is noteworthy that all the "Towns" will be in commission within eighteen months of their laying down, which were as follows:—*Bristol*, March 23rd; *Glasgow*, March 25th; *Gloucester*, April 15th; *Liverpool*, February 17th; *Newcastle*, April 14th, 1909. The *Mainz* and her sisters, however, will all exceed two years—the *Kolberg* was laid down in March, 1907, and was not completed until December, 1909: thirty-three months!

Regarding the future development of the protected cruiser, there seems good ground for thinking that the Admiralty policy favours the continuance of construction of two types of ship, the "Scouts" of the *Bellona* and projected "Active" classes, in which gun-power will be sacrificed for speed, and the improved "Towns," which will go on growing in offensive power until it is quite possible that something almost as big as the "County" 9,800 tonners will be evolved. If, however, the demand for numbers influences the restriction of displacement, we shall see the numerous 6-in. battery gradually replaced by fewer and heavier power until the design materializes which was on the *tapis* last year, to replace the *Edgar* class, now almost worn out. This allowed for one or two 9·2 in. guns, and a secondary battery of 4 in. q.f.

Meanwhile the small cruiser is being gifted with a sea-speed which should make her of great service in war as a torpedo-boat destroyer. Few, if any, of the older torpedo craft could run away from the *Bristol* or *Blanche* in a sea-way, and the thirty-one vessels ranging from the *Gazelle* to the *Mainz* are likely to prove as much a menace to our destroyers as any of the German torpedo craft.

Thus it will be seen that, far from having no war value, the small cruiser is likely to prove of the very greatest service as scout, convoy, destroyer and opponent of hostile cruisers.

TABLE I.—Speed Trials of "Town" Class.

	22 hours at ⅔ power.			8 hours at full power.		
	Speed.	Power.	Coal Consumption.	Speed.	H.P.	Fuel Consumption.
Liverpool ..	23·88	14,100	1·57 lb.	26·17	24,718 25,000	1·65 lb.
Newcastle ..	23·24	14,038	1·75 lb.	26·4	24,669	
Gloucester ..	24·84	19,116				
Glasgow ..	23·7	14,055	1·6 lb	25·8	22,500	1·6 lb.
Bristol ..				26·84 —27	24,227	

TABLE II.

Bristol John Brown & Co	Displacement—4,800 tons. Dimensions—344 ft. (430 ft. over all) × 47 ft. × 15 ft. 3 in. Armament—Two 6 in., ten 4 in., two T. tubes. Protection—3 in. (?) armoured deck. Machinery—Turbine. Boilers—Yarrow. Designated H.P.—22,000=25 knots. Highest speed yet attained in class—*Liverpool*, *Bristol*, 27 knots.
Glasgow— Fairfield	
Gloucester Beardmore	
Liverpool Vickers-Maxim ..	
Newcastle Elswick	
Mainz Vulkan Co.	Displacement—4,300-4,350 tons. Dimensions 387 ft (400 ft over all) × 43½ ft × 18 ft Armament—Twelve 4·1 in., four 5 pdr., four machine, two T. tubes. Protection—2-¾ in. armoured deck. Machinery—Turbine. Boiler—Schulz-Thornycroft. Designated H.P.—20,000=25·5 knots. Highest speed in class—*Mainz*, 28 knots.
Kolberg Schichau	
Köln Krupp	
Augsburg Kiel	

NAVAL MATTERS—PAST AND PROSPECTIVE.

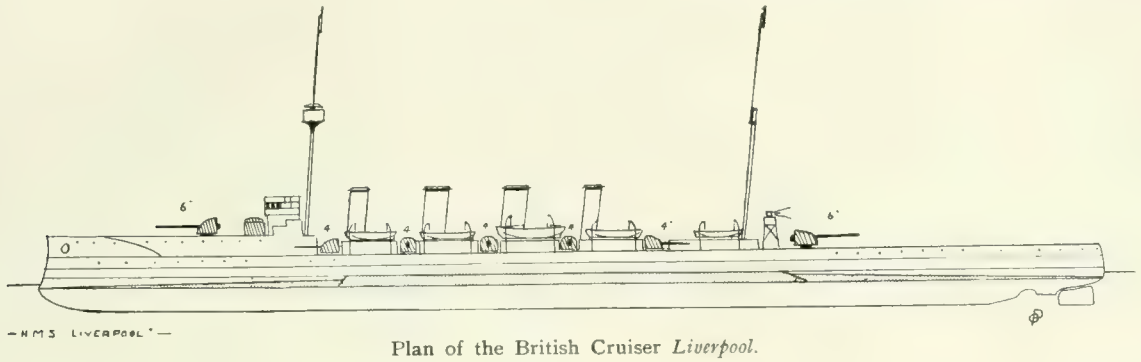
(*From our Own Correspondent.*)

Portsmouth Dockyard.

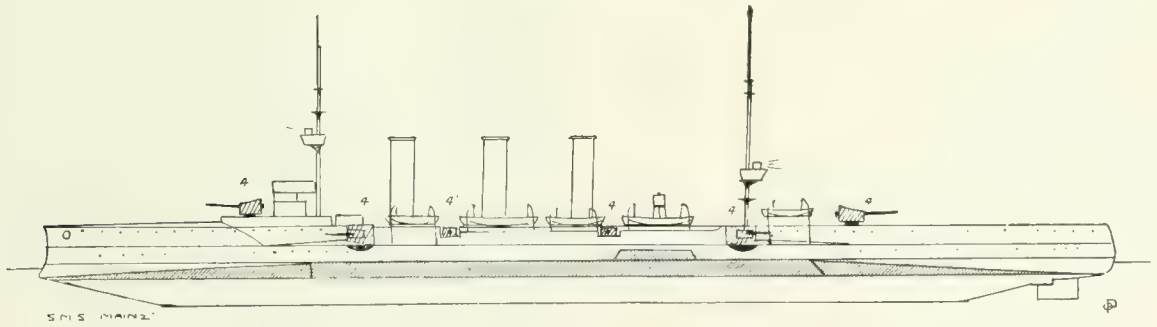
THE steam trials of the battleship *Neptune* have proved entirely successful. The stipulated horse-power was considerably exceeded, and the mean speed of 21·5 knots was reached on several runs. It is, however, intended to fit the vessel with propellers having a different pitch to the blades, so as to further improve the speed, if possible, as has previously been done with several other large vessels, usually with satisfactory results. The gun trials have also been successful, and it is understood that the ship, so far as the structure is concerned, bore the severe tests to which the guns were put remarkably well, the only damage being to the light fittings, some of which are always broken on occasions of such heavy strain. The battleship *Orion* has been placed in No. 15 Dock for her under-water fittings to be attended to. The vessel completely fills the dock, and had her beam been a couple of feet more it would have been impossible to have got her in. Nothing has been announced as to the new vessel which is to be laid down in January, but it is understood that she will be larger than the *Orion* and will be armed with 13·5-inch guns. A rumour has been in circulation that the keel plates are to be laid down before the end of December, but beyond the fact that the building slip is being cleared and the usual preparations being made nothing else is being done. The cruiser *Essex*, of the Fourth Cruiser Squadron, has been undergoing an extensive refit, and left to join the squadron for a cruise to South America on October 18th. It was found necessary to work day and night shifts to ensure her being ready by the stipulated time. The *Balmoral Castle*, with the Duke and Duchess of Connaught on board, left for South Africa on October 11th. The cruiser *Duke of Edinburgh* escorts the vessel as far as Sierra Leone and the cruiser *Defence* the remainder of the voyage. The *Balmoral Castle* is commanded by Commodore Wemyss, who is an Aide-de-Camp to the King. The cruiser *Hermione* has taken up duty as parent ship of the naval airships. Captain M. F. Sueter, who has been appointed to the command, and who will be the first Inspecting Captain of Airships, is a torpedo officer who assisted in the introduction of the submarine into the British Navy. He is the author of the first technical work on submarines. Probably before long he will write a similar work on aerial craft. Captain Sueter had been on special service in connection with airships for the past year.

Devonport Dockyard.

Our new vessel, which is to be a battleship, will, it is stated by those who profess to know, be named the *Royal George*, and even before the ship is laid down one of our local journals announces that the King will perform the naming ceremony. Although it has been officially stated that the vessel will not be laid down until January, there are indications that the date will be accelerated. Tenders have been accepted for the machinery, and the slip at the Mutton Cove end of the yard is being got ready. Good progress continues to be made with the two vessels under completion. Practically all the seven boiler-rooms of the *Lion* are completed and the 70,000 horse-power installation of forty-four heavy boilers in seven rooms is somewhat of a record. The cruiser *Indefatigable* is so well advanced that the programme of her trials will probably be issued by the time these lines appear in print. At the end of September the cruisers *Cornwall* and *Cumberland*, training ships for cadets, left the port, the former for a six months' cruise to the West Indies and the Mediterranean and the latter for a shorter cruise to the Mediterranean only. The cadets obtain much practical training during these cruises. The destroyer *Bittern* arrived on October 8th after a somewhat eventful voyage. Having undergone a refit at Gibraltar, she left there on September 26th, but her condensers becoming leaky, she put into Lisbon for repairs. While at her moorings a tug collided with her, and she had to be placed in the dock. The *Bittern* left Lisbon on October 3rd, the day before the revolution began, and putting into Corcubion two days later in consequence of rough weather, those on board were quite surprised to hear that a revolution had taken place. While the local submarine flotilla was carrying out exercises off Plymouth on October 7th it was found that the propeller of *A7* was working loosely on the shafting and *A8* was ordered to tow her into harbour. Before the vessels were able to reach Plymouth Sound the hawser parted three times and on the last occasion the loose end fouled the propeller of *A8* and disabled her for



Plan of the British Cruiser *Liverpool*.



Plan of the German Cruiser *Mainz*.

towing service. Submarine *A9* was then requisitioned to take the former vessel in tow. The two disabled vessels were eventually brought into harbour by tugs. Some rather good prices were obtained at the sale of obsolete warships on October 13th. The battleships *Edinburgh* and *Howe* were sold respectively for £19,300 and £25,100 to Messrs. Ward, of Sheffield. The *Howe*, it may be recalled, was wrecked at Ferrol eighteen years ago and afterwards salved. The hulk *Tenedos II.*, which formerly formed part of the boy artificers' training establishment at Chatham, went for £7,525 and the destroyer *Swordfish* for £1,510. The latter vessel underwent an extensive refit last year and was afterwards found unserviceable. Another vessel to be disposed of was Torpedo Boat No. 106, which was sold for £505. The tug *Perseverance* was bought in by the Admiralty at £1,950. Vice-Admiral Cross gave a farewell dinner on October 3rd and the following day vacated the post of admiral-superintendent after holding it for two and a half years. Rear-Admiral Stokes has succeeded him.

Chatham Dockyard.

It is anticipated that our new cruiser will be laid down early in November and No. 8 slipway is practically ready for her. Many of the blocks have been prepared and the work of altering the ground ways is nearly completed. We are anxiously awaiting the laying down of the vessel, as it is over four years since the last cruiser—the *Shannon*—built at this yard was launched. The *Intrepid*, the last of the seven cruisers to be fitted as mine-layers, has been commissioned for special service. The work of converting obsolete cruisers into mine-layers has given work to a large number of men at this yard during the last few years. There is, however, at present plenty of other work in hand. The cruiser *Euryalus*, having had a thorough overhaul and refit at a cost of over £70,000, has been commissioned for service in the Home Fleet. The *Tartar* and *Rother* have completed their refits and have proceeded to Fortrose to rejoin the First Destroyer Flotilla. The latter vessel will shortly be relieved by the new destroyer *Nautilus*, when that vessel is delivered from the Thames Ironworks. The gunnery training vessel *Endymion* is undergoing her annual refit, and is expected to be ready to resume her duties at Sheerness early in November. The cruiser *Inflexible*, which had been in hand for the past few weeks undergoing her recommissioning refit, has rejoined the First Cruiser Squadron in Scottish waters. The battleship *Lord Nelson*, of the First Division of the Home Fleet, has come in for her annual refit, as has also the *Maori*, of the First Destroyer Flotilla. The cruiser *Minerva* was recommissioned on October 18th for further service in the Mediterranean. She was delayed on her passage here through receiving orders to proceed to Lisbon on the outbreak of the revolution in Portugal. Submarine *C34*, the sixth submarine built at this yard, has been passed out of hand, and has proceeded to Portsmouth to join the flotilla at that port. The official visit of the Lords of the Admiralty took place somewhat later than usual this year. Their Lordships arrived from London on October 11th and went on board the Admiralty yacht *Enchantress*, which came in the previous day from Harwich. The usual inspection of the various establishments was made, but their Lordships did not receive any deputations. It is understood that a special visit will be made for that purpose shortly.

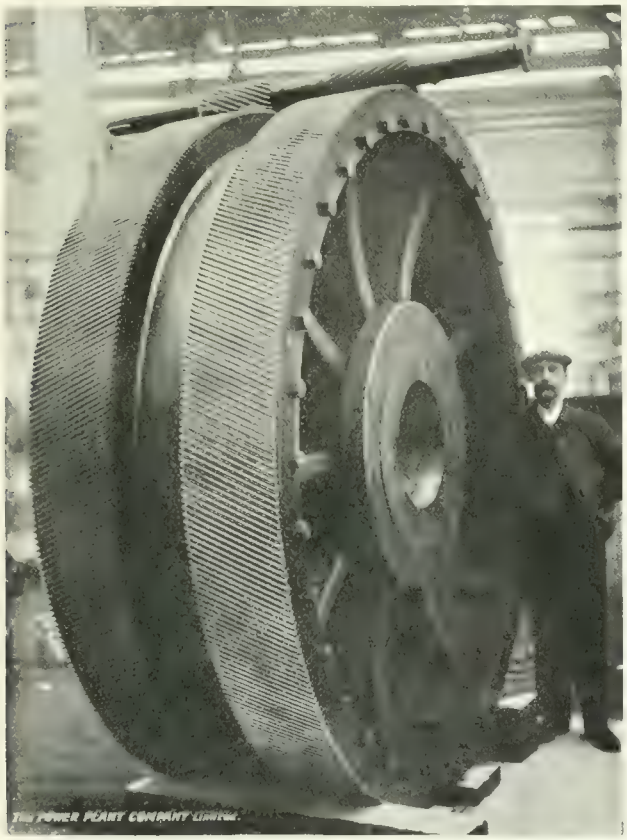
Sheerness Dockyard.

A rather unusual occurrence took place at this port a few weeks ago, about 150 labourers, who were employed in filling the coal hulks from colliers, going out on strike. The authorities, however, dealt very promptly with the matter and gangs of labourers were brought from Chatham, the work proceeding practically without any delay. A deputation of the strikers waited on Commander Lacy, in the absence of Captain Torlesse, the captain-superintendent, and asked that 10d. per ton should be paid instead of the existing rate. No change in the scale could be made without Admiralty consent, as the men might have known, and they were asked to resume work at the old rates and allow their request to be submitted to My Lords. The only thing that seems to have resulted from the strike is that about £500 has gone in wages to Chatham labourers instead of to men at this port. It is generally considered that the men were very ill-advised. The cruiser *Newcastle*, after having been commissioned at Chatham, came here to complete her preparations for sea, leaving on September 29th for China to take the place of the lost *Bedford*. Her departure was somewhat of a record, only twelve days elapsing from the time she entered the Medway on delivery from Messrs. Armstrong, Whitworth & Company to the time she left for foreign sevrice. The vessel was, however, delayed on her voyage. She had reached Gibraltar and in consequence of the revolution in Portugal was ordered to proceed to Lisbon to protect the interests of British subjects. She, however, only remained there two or three days, and then went on to Malta. Unfortunately after leaving Malta internal defects developed and she had to put back for repairs, which were expected to take eight days. The mine-layer *Intrepid* arrived from Chatham on October 5th and having shipped ammunition proceeded to the Firth of Dornoch, where the mine-layers of the Nore Sub-Division carried out a series of exercises. The torpedo gunboat *Skipjack* came in on October 8th with the French trawler *G599*, which she had arrested at the mouth of the Thames for fishing within the three mile limit. The captain was subsequently fined five guineas. The torpedo gunboat *Harrier*, which has had an extensive refit, has returned to Portsmouth to resume her duties as tender to the navigation school ship *Dryad*. Submarines *C7*, *C8* and *C9* were refloated on October 14th on the completion of their refits and have rejoined the East Coast Flotilla at Harwich. Submarines *C2*, *C5* and *C6*, of the same flotilla, have since come in for dry docking. We hear that the floating dock which is being built on the Tyne is making good progress. No official announcement has been made as to the site selected for the dock on its arrival in the Medway next autumn. It will probably be near this port, as fogs are very prevalent during the autumn and winter, and they are always more dense in the upper reaches of the river than here. If berthed very high up the river it would be almost impossible to get at the dock in a very thick fog.

Pembroke Dockyard.

Excellent progress is being made with the cruiser *Blonde*. The turbines have been shipped and the decks over the two engine-rooms are being closed down and the deck fittings are being proceeded with. The cruiser *Blanche* has carried out her acceptance trials very satisfactorily, Commander Browne, of the cruiser *Vindictive*, and a navigating crew coming from Chatham to join the vessel. The *Blanche* was laid down on April 12th, 1909, and launched on November 29th following. She has cost £288,000, and is to be commissioned immediately for service in the Home Fleet. Our new cruiser, the *Active*, has now been under construction for three months, but it cannot be said that she is making very rapid headway. She, however, is progressing steadily, or to use a somewhat hackneyed phrase, "as well as can be expected." The destroyer *Brazen* arrived at the beginning of the month. The vessel, it was understood, was to have undergone a thorough refit, but she only needed some small repairs to her machinery, which were completed in a few days. She will probably come in for the refit later on. The destroyers *Kestrel* and *Lively* are to undergo thorough repair refits at this yard, and the *Sprightly* and *Cheerful* will shortly be sent here for their annual refits. The *Avon* and *Foyle* are still in hand. It will thus be seen that destroyer refits are to become an important part of our work. Torpedo Boat No. 045 has arrived here for service with the torpedo-boat flotilla, which now consists of four vessels, Nos. 033, 041 and 049 being the others. The flotilla will doubtless be gradually added to. The visit which Dr. Macnamara, the Parliamentary Secretary to the Admiralty, paid to this yard recently was remarkable because of the lengthy interviews granted to several of the deputations. The long audiences were not at all expected, as a programme had been drawn up by the authorities limiting each of the deputations to five minutes. Dr. Macnamara did not fall in with the idea of limiting the duration of the interviews. He had come, he said, to hear the workmen's representatives, and he intended to hear them fully. Needless to say, Dr. Macnamara has won golden opinions among the men, and should any material good result his popularity will be still further enhanced. Captain Mundy, our captain-superintendent, has been awarded the Good Service Pension of £150 a year in the vacancy caused by the retirement from the Service of Captain Winnington-Ingram. The latter officer, who was lately serving at Portsmouth, is a brother of the Bishop of London.

The Engineering Standards Committee. — The revised specification for structural steel for shipbuilding, Report No. 13, revised September, 1910, has recently been issued, and is published for the committee by Messrs. Crosby, Lockwood & Son, price 5s. nett. In consequence of representations which have been made to the committee in regard to the failure of plates under cold flanging, the maximum tensile strength for plates intended for this purpose has been reduced from 32 tons per square inch to 30 tons per square inch, but no alteration has been made to the lower limit of tensile strength or to the elongation, which remains the same as before. In issuing the revised specification an opportunity has been taken for providing for the use of the four diameter test piece (Standard Test Piece F), when bars above 1 in. diameter are tested full size as rolled, or have been turned down and the resulting test piece is above 1 in. diameter. Copies of the specification may be obtained from any bookseller or the offices of the Committee, 28, Victoria Street, Westminster, S.W.



Readers of our journal will remember the paper on "The Application of the Marine Steam Turbine and Mechanical Gearing to Merchant Ships," contributed by the Hon. C. A. Parsons at the spring meeting of The Institution of Naval Architects last March, and which paper was reported in full in *The Marine Engineer and Naval Architect*, April, 1910. It was stated therein that the Turbinia Works Company decided to test turbines mechanically geared to the screw shaft of an existing typical slow-speed vessel, and the *Vespasian*, a cargo vessel of 4,350 tons displacement, was purchased for the purpose. A reproduction of a photograph of the *Vespasian* gear is given above. This gear was cut by The Power Plant Co., Ltd., of West Drayton, Middlesex, to whom we are indebted for the illustration.

LLOYD'S REGISTER OF SHIPPING.

Annual Report.

ACCORDING to the Annual Report of Lloyd's Register, covering the period to June 30th, the total iron and steel steam tonnage on the register amounted to 18,782,708, the number of vessels being 8,992; the sailing tonnage 1,725,834, and the number of vessels 1,132. In addition to these were 178 wood and composite vessels, with a tonnage of 26,945. The new total tonnage added during the year ending June 30th was 929,946, embracing 461 steam and 79 sailing vessels, the latter aggregating 6,243 tons. The tonnage built for the United Kingdom was 612,825, and the balance for the Colonies and abroad. The new vessels for 1908-9 made up a total of 854,984 tons, of which 9,265 was sailing tonnage, showing a falling off in 1909-10 of 3,022, but an increase of steam tonnage of 77,984. The largest amount of new tonnage in one year during the last ten years was in 1906-7, when the total tonnage was 1,484,722, of which the steam was 1,470,312, and sailing 14,410. The year 1902-3 gave a steam tonnage of 1,182,265, and a sailing tonnage of 68,155, this being the largest of the ten years for sailing vessels. During the eight years prior to 1908-9, the total new tonnage for each year was over the million. Not yet has the internal combustion engine appeared in the list, but a year hence it will probably have a column to itself and open the record, as now there are several vessels under way, which are referred to in the Report as under construction, under the supervision of the surveyors. Three vessels are under construction on the Continent; these are to be fitted with Diesel oil engines. One set is to be of the four-stroke cycle, with single-acting cylinders with about 450 I.H.P.; another set of the two-cycle, single-acting, is for a twin-screw vessel with about 900 I.H.P. for each shaft. The other is to be of the two-stroke cycle but double-acting, each cylinder giving two impulses each revolution of the shaft, also for a twin-screw vessel, with a total I.H.P. of 1800. These are all reversible engines, and will therefore require no intermediate gearing for reverse action. A set of Producer gas engines for a vessel of about 260 tons is under construction in this country to use anthracite coal, the engines are intended to run a high rate of speed with non-reversible engines. The reversing is to be accomplished by means of a hydrodynamic transformer. A turbine water pump driven by the engine is designed to deliver to another turbine coupled direct to the propeller shaft, the latter running at a lower rate of speed than the engine. These sets, being of different types, will prove of very great interest and importance to marine engineers, as well as to the shipping community, and their movements will be as closely followed as may be possible with a view to results and comparisons. Among the largest steamers built during the year over 10,000 tons are the *Balmoral Castle* (13,361), *Edinburgh Castle* (13,326), *Orvieto* (12,130) and *Otranto* (12,124), and now under course of construction the *Franconia* and *Laconia*, of about 19,000 tons each. It is stated in the Report, also, that forty-three vessels, aggregating 176,000 tons, have been built on the Isherwood system of construction.

STABILITY INDICATOR FOR SHIPS.

AT the Institute of Marine Engineers a demonstration with the patent G.M. Balance or Stability Indicator for Ships was recently given by Mr. W. Fredericks, assisted by Mr. Edwin Tate, the inventor of the indicator. In the course of a short paper descriptive of the instrument and the purposes for which it was designed, Mr. Fredericks stated that the freeboard of a ship, as defined by regulations, did not assure, or even indicate, her condition of stability, for, should the centre of gravity be brought too high by a wrong stowage of cargo the fact of the ship having, or going to sea with, the freeboard assigned, could not prevent her from capsizing. Many ships had met with disaster both from capsizing, or "turning turtle," and from foundering caused by the excessive rolling in heavy weather, with the consequent shifting and breaking loose of cargo, straining and opening of seams and similar troubles, attributable initially to the wrong distribution or stowage of cargo, and want of knowledge of the actual condition of the ship's stability prior to leaving port.

The construction of the stability indicator was based upon the buoyancy, transverse metacentre, displacement and other naval architectural calculations, and was especially invented to provide a simple and reliable method of finding the metacentric height under any and all conditions of loading, actual or proposed. The balance consists of a beam, the length of which (from, approximately, two to three feet) is made in proportion to the depth of the ship concerned, from any reasonable height above the uppermost deck, as may be required, to the keel. On this beam are marked to scale the positions of the tank top, decks, etc.; also a scale of the positions of the transverse metacentre at different draughts from the light condition of the ship to the load line, and a scale of the deadweights corresponding to the respective draughts. At the bottom of the beam is a bar, on which weights can be suspended at any desired point, the centres of the cubic capacities of the different holds, coal bunkers and ballast tanks being given for this purpose and indicated on the beam. The beam represents the ship when in light condition, and the weights referred to represent deadweight (*i.e.*, cargo, coal and water ballast) and are proportionate to same. The weights range in number and size to the dimensions of the ship concerned, and have hooks by means of which they can be attached in position on the bar.

Two side davits support the beam, whilst a centre one is utilized for balancing purposes by means of a lever attachment. When the beam is balanced at this lever, the indicator on the latter denotes the position of the centre of gravity of the ship; whilst the metacentric height is demonstrated by the distance the centre of gravity is below (nearer the keel), the metacentre mark corresponding to the draught concerned.

Weights can be placed on the bar of the balance representing all the cargo, coal, etc., to be taken on board, and this equally as well prior to loading as during or subsequent to same. The stowage can be so arranged that the required "margin of safety" or satisfactory condition of stability and seaworthiness, can be arrived at under any or all conditions or circumstances.

The instrument and weights are specially constructed for each individual ship, based on her dimensions, lines, etc., necessitating specific information peculiar to the ship for which it is intended.

A demonstration was then given with the instrument, weights representing the cargo being suspended on the balance in position according to the distribution of the cargo in the vessel throughout the different holds, tanks, etc. On the whole of the cargo being represented the beam was balanced and the metacentric height ascertained, showing that the cargo was distributed in such a manner as to give a good margin of safety.

RECORD BATTLESHIP-CRUISER "LION."—The publisher has a few photogravure prints of this superb vessel at the following rates. Plain prints, 1/- each; india proofs, signed by artist, 2/-, printed surface 9 in. by 6 in., size of mount, 15½ in. by 11½ in.; framed prints, 2/- extra.

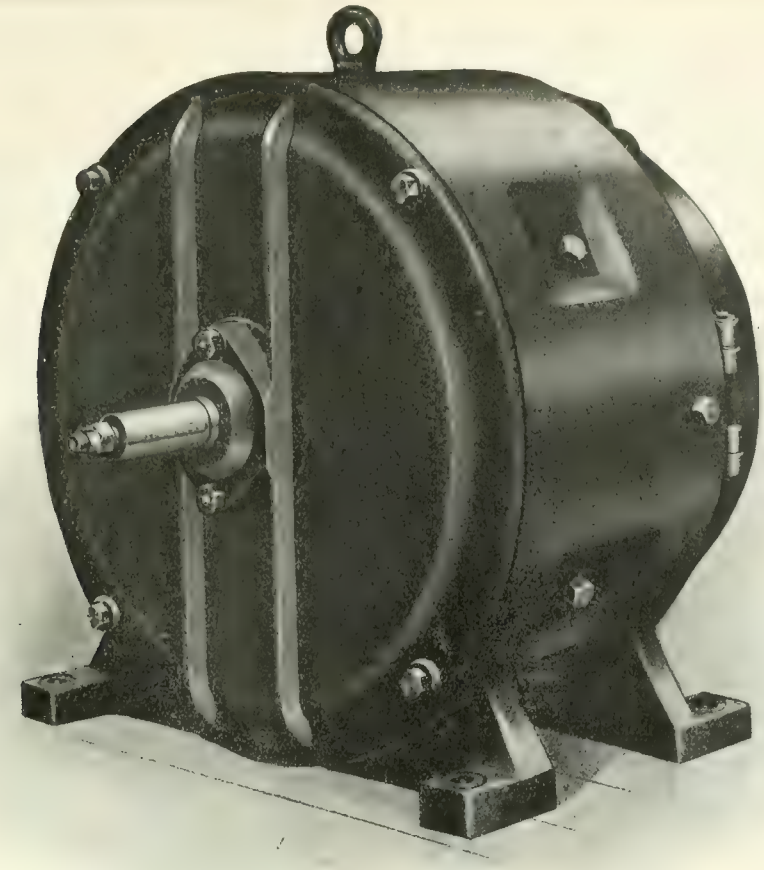
ELECTRIC MOTORS FOR MARINE PURPOSES.

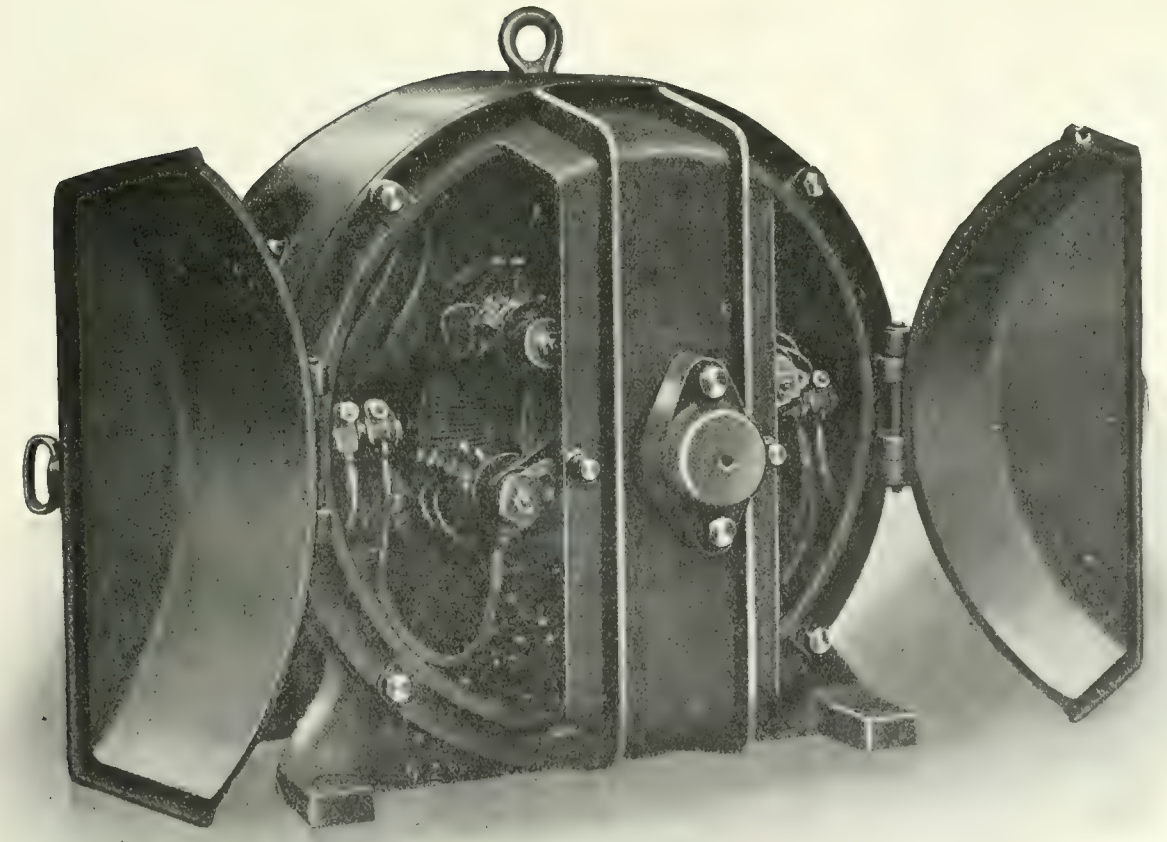
A CONSIDERABLE amount of information has recently appeared in the technical press concerning the availability of electricity for purposes on board ship, and in this connection it is interesting to refer to a type of motor which has been specially developed with reference to the requirements of marine practice.

The totally enclosed marine type motors manufactured by the firm of Messrs. Royce, Ltd., of Manchester, have for some time past been successfully employed for auxiliary purposes on board vessels, more especially in conjunction with such uses as the barring gear in connection with marine steam turbines. They are of a type which are specially designed for use in inaccessible or abnormal situations and are of the completely enclosed type. A special feature of their construction is the provision of double-thrust ball bearings lubricated with solidified oil and so designed as to eliminate all armature end play. This arrangement permits of these motors running for very long periods, varying from six months to two years, according to the duty, without any attention. The advantages obtained by the use of motors designed in this way are numerous, and may be summarised as follows. There is no necessity for the greaser to attend to the bearings for longer or shorter intervals, inasmuch as oil is not used and there is a complete absence of bearing troubles due to the entrance of grit or dust, as the bearings are completely enclosed and dust-proof. In addition to this there is an elimination of all troubles due to the oil being thrown upon the windings or being emptied from the bearings by the pitching or rolling of the vessel. Engineers who have had experience of electrical auxiliary machinery, as for example the motors employed in driving fans, will be aware that unless all end play is taken up there is considerable danger of friction and bumping if the vessel has any list. In this particular design the use of the double-thrust bearing eliminates this danger and an increased efficiency is secured owing to the use of high-class ball bearings. Another advantage which is of particular value on board ship is the saving of an appreciable space lengthwise, due to the compact nature of the design of the motor, which is often of considerable moment, especially in marine work; and there is the further convenience of being able to fix the motors with the shafts at any angle between horizontal and the vertical without any special provision.

These motors are electrically designed so as to be supplied either compound, shunt or series wound, according to requirements, and in a variety of sizes ranging from 3 b.h.p. to 65 b.h.p.

An objection has been frequently raised to ball bearings on account of their price, which has been alleged to put up prices of motor equipment to an excessive amount, and this is a serious consideration, more especially in the mercantile marine. As a matter of fact, however, owing to the simplicity and solidity of the design, these motors are supplied at prices only slightly in excess of those of machines of equal horse-power and speed fitted with ordinary





Totally-Enclosed Marine Type Motors, made by Messrs. Royce, Ltd.

bearings, and the advantages in the saving of space and elimination of attention more than compensate for the slight increase of price. The illustrations shown herewith give a view of the 10 b.h.p. motor supplied for marine purposes, the views showing the accessibility of the commutator brush gear, connectors, etc., and the standard extension of shaft suitable for the attachment of a pulley, pinion or half-coupling.

INTERNAL COMBUSTION ENGINES.

AT the Institute of Marine Engineers on October 10th an adjourned discussion took place on Mr. W. R. Cummins' paper on "Internal Combustion Engines for Marine Use," and on Mr. F. J. Kean's paper on "An Experimental Study of an Oil Engine."

In replying to the previous discussion, Mr. Cummins stated, with reference to the difficulty that the gas engine was liable to pull up in a heavy sea and not be able to pick up its load again, that this fault was peculiarly that of the four-stroke engine, and that the remedy was to use a two-stroke engine and a sufficient number of cylinders to ensure a positive torque during the whole period of the revolution of the crank shaft. When four cylinders were adopted, which would be the case in engines of moderate power, the compressed air for starting and reversing would be used for giving an upstroke only; that was to say, it would be admitted to the bottom end of the cushioning cylinder advocated in the paper. This would leave the power cylinder and the pump cylinder free to take up their functions as soon as the compressed air had started up the engines in the desired direction.

With regard to scavenging, in the system he proposed the cold scavenging air was admitted to the upper part of the cylinder immediately after the exhaust ports opened to the atmosphere. The explosive charge followed through the same valve (which was the only valve exposed to the explosive pressure), and pushed out of the cylinder, not only the hot gases, but the greater part of the scavenging air. The scavenging air thus formed a buffer between the hot exhaust gases and the explosive mixture. The best method of ignition was electrical, with facilities for tuning the spark. The magneto system, in his opinion, should be used for the main engines. The auxiliary engines might require in addition a battery and coil.

In reference to reversing the gas engine when the vessel was going at full speed, there would be no difficulty in this respect with the compressed air system proposed. The ignition would be cut off, and the reversing gear operating the distributing valves for compressed air to the cushioning cylinder would be put in the astern position. The conditions would then be exactly the same as when a steam engine was reversed from ahead to astern, compressed air from the receiver taking the place of steam from the boilers.

Mr. F. M. Timpson agreed with Mr. Cummins that the two-stroke engine was the most suitable for marine work, seeing that it was the simplest in construction and easiest to reverse. He also was of opinion that the two-stroke engine was not so economical as the four-stroke, although in small powers he had known two-stroke engines give more economical results than four-stroke. For small powers he did not think crude oil very advantageous. Where there was unskilled labour it created more difficulty and cost more in upkeep. The general tendency was not to increase the size of cylinder, but to increase the number, although he understood that very large cylinders were being built by firms on the Continent.

Mr. E. Shackleton said that the practice of using a long exhaust pipe and a partial vacuum, referred to in the paper, was, he believed, almost entirely abandoned. The cushioning advocated by Mr. Cummins was a matter which had not received much attention from builders, and, presumably, it was not found of great advantage. Bituminous fuel, in his opinion, was superior to crude oil, unless the latter could be obtained at a very low figure. The two-stroke engine was without question much more extravagant than the four-stroke.

Mr. Jas. Adamson (hon. secretary) said he understood there were boats on the American Lakes driven by internal combustion engines of up to 700-h.p., and referred to the great advances made in the development of the internal combustion engine during recent years.

The discussion was reopened on October 17th, when Mr. F. M. Timpson gave a comparison between a small vessel with an oil engine of 90 brake horse-power, and a speed of 8½ knots, and a steam-driven vessel of similar size and speed. The comparison was taken for a nine weeks' run, and at the end of that time the result showed a saving of over £90 in favour of the oil engine. He did not agree with Mr. Cummins that the pump was a necessity for forcing in fuel in the two-stroke engine, and the practice of mixing the charge in the crank case was done away with. He was glad to see that British firms were beginning to build large engines, and he knew of one firm on the North-East Coast who would be prepared in a week or two to undertake work of the magnitude of that undertaken by any of the Continental firms.

Mr. A. Robertson said there were two principal points to be considered from the marine engineer's aspect—the questions of reliability and the cost of fuel. The price of oil might be low in one part of the world, but it varied greatly, and might be exceedingly more costly than coal in some foreign ports. He was aware that the oil engine had reached a good stage of reliability, but he knew a number of engineers who, while preferring the oil engine on the question of cost, yet selected the steam engine for its greater reliability.

Mr. G. W. Newall remarked that he would be interested to note how the gas or oil engine withstood heavy weather conditions at sea. Another matter to be considered was the difficulty which would be experienced in getting rid of the products of combustion. The odour might become very apparent. There was also the increased possibility of oil getting into the bilges, with harmful effects. He wished to know the comparative weight of the oil or gas plant as compared with that of the steam engine, and the limit of power proposed for gas engines in marine work. It would be a matter of difficulty, in his opinion, to dispose of the enormous amount of heat generated in the cylinders in large installations, and this would doubtless cause a great deal of discomfort in the engine-room.

Mr. J. G. Hawthorn said that to dispose of the products of combustion would present little difficulty. In some cases the products of combustion were discharged below the water-line, and the odour was to a large extent eliminated. The question of the heat generated was also a matter which might be overcome by the use of suction fans, as with the steam engine.

Mr. E. Shackleton stated that the new Hamburg-American liner was guaranteed to give 3,000 h.p. at a consumption not exceeding 16 tons of fuel oil per day. The reliability of the oil or gas engine was beyond question, as in very many instances on shore enormous issues depended upon the engines being thoroughly reliable. With regard to the heat generated, he suggested that this could be utilized as the motive power for a central turbine for reversing purposes in large installations. He considered that 2,000 to 3,000 horse-power would be the limit of power at the present time for gas engines, and that tramp steamers, where the question of profit was the main consideration, would be the first in which the internal combustion engine would be fitted generally.

The meeting closed with a vote of thanks to the chairman.

THE firm of Wailes, Dove & Co., Ltd., who exhibit, in the Transportation Section of Building No. 48, at the Japan-British Exhibition, their patent "Bitumastic" enamels as applied to the ships of the British and foreign Admiralties, and of the mercantile marine throughout the world, also to the plant of the chief industrial concerns, railways and municipal corporations in the United Kingdom and abroad, have been awarded diploma of the highest merit with gold medal. This firm also received gold medals at Genoa, 1905, Milan, 1906, Savona, 1906, Bordeaux, 1907, Franco-British Exhibition, London, 1908, for superiority of the anti-corrosive qualities of their patent "Bitumastic" enamels coverings and solution.

KLINGER'S IMPROVED GAUGE COCKS.

TIME has shown that asbestos-packed cocks have filled a place in the category of useful and efficient fittings which could never have been attained by metal to metal cocks. In spite of this utility, however, it must be recognised that wear and tear cannot be entirely eliminated, particularly at that spot where the asbestos packing is called upon for its best and most continuous service, consequently the functions of the device are not completely satisfactory. Experience has shown that high-pressure steam and water, foreign matter present and the chemical action that is set up, all conspire together to wear away the comparatively small surfaces which rub on one another when the plug of the cock is turned while the packing material itself has a tendency to gradually wear away

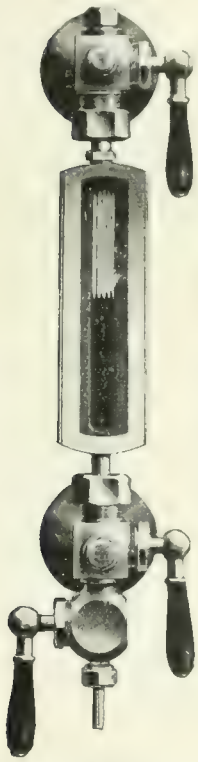


Fig. 1

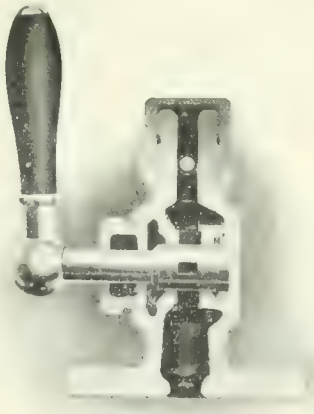


Fig. 2

all the time. In cocks of known construction mere slackness can be remedied to a certain extent by the introduction of more packing, but, hitherto, any wear of the metal surfaces has entailed the dismounting of the fittings and their renovation in the engineering shop.

In order to overcome these grave disadvantages Messrs. Richard Klinger & Co. have devised a new form of construction, which, however, is of a simple character, although the resultant effect is very far-reaching from the standpoint of time and money saving. The mere principle embodied in the construction can be applied to both upper and lower gauge cocks as well as the blow-down cock, and can be adopted for valves, test cocks, stop cocks and other devices when adaptable.

We will illustrate the construction in the adjoining diagrams to simplify the description. Fig. 1 shows a pair of the improved gauge cocks fitted to the well-known Klinger's "Reflex," water-gauge of the "attachable" pattern, and fig. 2 is a sectional plan of one of the cocks showing the improved arrangement.

It will be noticed that the cock or valve body is hollowed out for the reception of a removable inner cup or shaped lining, the outside of which fits accurately into the said hollow. This lining is fitted with the best quality asbestos packing, the plug working in the centre in the usual manner. By means of this arrangement whenever the packing becomes inefficient, the lining with its packing may be readily removed and a new liner with packing installed therein can be substituted at a small cost, thus making the whole fitting as good as new. If the plug itself should become worn also, this can be replaced by a new one, as all parts are standardized.

It is difficult to overrate the advantages of this improvement for the reason that the gauge casing lasts indefinitely and need never be discarded or even removed from the boiler during its life, the delay caused by dismounting and sending the ordinary pattern cocks to be repaired is entirely avoided, and lastly, any mechanic can effect the change from old to new in a few minutes at an infinitesimal cost.

SCOTTISH INSTITUTION OF ENGINEERS AND SHIPBUILDERS.—The Institution of Engineers and Shipbuilders in Scotland opened its fifty-fourth session on October 25th, when in the "Rankine" Hall of the Institution buildings, Elmbank Crescent, the new President, Prof. Archd. Barr, B.Sc., delivered his Presidential Address before a large turnout of members. A paper on "The Block Co-efficient" was also read by Mr. P. A. Hillhouse, B.Sc., of the Fairfield Shipbuilding & Engineering Co., Govan. Amongst other papers which are to be read and discussed during the session are: "The Detection of Petroleum Vapour or Gas," by Mr. J. H. Heck, principal engineer-surveyor, Lloyd's Register, Glasgow; "Boiler Economies as Effected by the Use of High Gas Speed," by Dr. J. T. Nicholson, Manchester; "Design and Construction of Factory Chimneys," by Mr. A. W. Brown, Belfast; "Internal Combustion Engines," by Mr. E. Hall Brown, of Messrs. Rodger & Co., Govan; and "The Utilisation of Waste Energy in Steel Works," by Mr. T. B. Mackenzie, of Dalziel Steel Works, Motherwell. Arrangements are being made for holding in the Berkeley Hall on November 18th—in connection with a conversazione in the St. Andrew's Hall adjoining—an exhibition of science and industry consisting of objects of historic and up-to-date interest in the shape of models, drawings and photographs relating to engineering and shipbuilding. The proceedings of the Institution during last session have now been issued in volume form, forming a compact and thoroughly attractive and interesting record of the papers and discussions of the past session. The plan of embodying illustrations and tabular matter as much as possible in the body of the letterpress—thus obviating the awkwardness of many large folding plates—is a taking feature of the present volume, and the production as a whole reflects credit on the printers and on the secretary of the Institution, Mr. Edward H. Parker.

APEXIOR.—Messrs. J. Dampney & Co., Ltd., have had a gratifying letter from a user of their "Apexior," who states that the boiler of a new steamer was giving serious trouble; nearly everything was tried to stop the "bleeding," and did not seem of any use. After giving it one coat of "Apexior" he had no further trouble with the boiler. Messrs. Dampney and Co. inform us that "Apexior" compound has just been specified for coating three boilers of a large new steamer now building for Messrs. R. Chapman & Son, and it has also been supplied during the past few months to, among others, the Allan Line, Atlantic Transport Line, Pacific Mail S.S. Co., etc.

THE WHITE STAR LINER OLYMPIC.

ON the 20th October the White Star leviathan *Olympic* parted company with her sister ship, the *Titanic*, on *terra firma*, and took to her natural element. The day was brilliant with sunshine, and the climatic conditions generally were all one could wish for. What struck one as remarkable was that, in spite of the fact that the largest ship in the world was that day being launched, there was practically no external display of enthusiasm; the shipyard of Messrs. Harland & Wolff was much as usual, and there was an absence of any ceremonial whatever, giving one the impression that the event was one of every week's occurrence for example. The vessel has a length of 882 ft. 6 ins. over all, and a breadth over the boat deck of 94 ft.; her displacement is 66,000 tons, and her gross register tonnage is 45,000. As a comparison with the Cunard Company's *Mauretania* of 33,000 gross register tonnage, it will be noted that the *Olympic* is about 34% larger. The launching weight was 27,000 tons, and the time occupied from the start into motion until she was completely waterborne was 62 secs., the highest speed attained during the process being 12½ knots. The ways were coated with 22 tons of grease, and so generous was the surface area allowed that the cradle and ways never came into contact, but were maintained apart by the layer of grease. The force of gravity resolved into the direction of the inclined ways was, just before the launch, when the ship was maintained in position by the launching triggers, about 435 tons.

The arrangements in connection with the launch of a ship do not end with the release of the vessel so that she may slide down the ways into the water; they include provision for checking the way on the vessel when in the water, as most launching rivers or basins are more or less limited in breadth, and in the case of a gigantic fabric like the *Olympic* the means adopted will doubtless be found interesting. In the bed of the river were placed three heavy anchors on each side of the ship, each anchor being connected by a 7-inch steel-wire hawser to eyeplates riveted to the shell plating. There were also placed in the bed of the river two piles of cable drags, each weighing over 80 tons, connected in a similar manner with an 8-inch steel-wire hawser. These were all arranged so that when the vessel was nicely clear of the end of the slip the drags and anchors acted simultaneously in bringing the ship to a standstill. As a further precaution the ship's own bow anchors were stowed in the hawse pipes, ready for letting go in case of emergency.

Besides being the largest and heaviest vessel ever launched, the *Olympic* is undoubtedly also the strongest. Both in design and workmanship this has been kept in view, and the most approved structural arrangements suggested by the ripest experience have been adopted, and every mechanical device requisitioned to secure this end. Never before in the history of shipbuilding have such elaborate means been employed, or such a combination of science, invention and skill in the production of a ship: nothing has been left to chance; everything has been carefully thought out and skilfully planned, down to the most minute details, and from keel to truck the *Olympic* will be as perfect as human ingenuity and skill and the most powerful appliances can make a vessel. The double bottom, extending the whole length of the vessel, 5 ft. 3 ins. deep (increased under the reciprocating engine room to 6 ft. 3 ins.), the massive beams and close framing, the large shell plates, the steel decks and watertight bulkheads combine to make a structure of exceptional strength and rigidity. The hydraulic riveting in the vessel is also an important factor, the whole of the shell plating up to the turn of the bilge being riveted by hydraulic power, and an immense amount of this riveting having also been carried out in other parts of the vessel—shell, top sides, decks, stringers, etc. The rivets were closed by means of the powerful 7-ton riveting machines suspended from the travelling frames on the gantry; and while making the sound, tight connection so essential in this mighty hull, the rivets studding the shell plating present a very pleasing and symmetrical appearance. There are half a million rivets in the double bottom alone, weighing about 270 tons, the largest rivets being 1¼ inches in diameter; and in the complete ship there will be something like three millions, weighing about 1200 tons.

The following particulars are interesting:—The largest shell plates are 36 feet long, weighing 4¼ tons each; the largest beam 92 feet long, the weight of the double beam being 4 tons; the stern frame weighs 70 tons; the after boss arms 73½ tons, the forward 45 tons; the rudder 100 tons; the engine crank shafts 118 tons each; bedplate 195 tons; columns 21 tons each; the heaviest cylinder, with liner, 50 tons: wing propellers each 38 tons—finished weights. The castings for the turbine cylinder weighed 163 tons, and for the centre (turbine) propeller, which is of solid bronze, 22 tons.

As already announced, the machinery decided on for the *Olympic* and her sister ship *Titanic* is the combination of reciprocating engines with a low-pressure turbine, so successfully adopted in the White Star Canadian Liner *Laurentic*, this arrangement having proved the most satisfactory from an engineering point of view, after comparison with the performance of her sister ship *Megantic*, fitted with quadruple-expansion engines and twin screws; the *Laurentic's* fuel consumption for the same speed being 14% less. At the same time the combined arrangement is most beneficial to passengers, retaining for them the most highly perfected reciprocating engine on the "balanced" principle, eliminating vibration, and thus securing the utmost comfort by the smooth working of the ship. As there will be accommodation for about 2500 passengers in all, besides a crew of 860, this arrangement is in keeping with the well-known practice of the White Star Line in making the comfort and safety of the passengers their first care. As some indication of the extent of the accommodation in this vessel, it may be remarked that there will be over 2000 sidelights and windows in the ship; and, needless to say, the sumptuous character of the appointments will be in keeping with the traditions of the firm. Full advantage is being taken of the enormous size and spaciousness of the vessel to excel anything hitherto attempted, both in the public rooms and private cabins; and the entrances, the magnificent staircases and other features will be on a scale of unrivalled magnitude and excellence, to say nothing of such items as the swimming bath, gymnasium, palm court, etc.

With regard to the propelling machinery it is

interesting to note there are twenty-nine Scotch boilers having 159 furnaces in all. Of these boilers twenty-four are double-ended and five are single-ended, having lengths of 20 ft. and 11 ft. 9 ins. respectively, while the diameter of each is 15 ft. 9 ins. The furnaces are of the Morrison type, 3 ft. 9 ins. diameter inside. The working pressure is to be 215 lbs., and it is probable that this pressure will be maintained by natural draught. The funnels are of elliptical section, 24 ft. × 6 ins. × 19 ft., and the approximate height above the furnace bars is 160 ft.

The reciprocating engines are in two sets of 15,000 I.H.P. each, one set for each wing propeller. The high-pressure cylinder is 54 ins. diameter, the intermediate 84 ins. diameter, and the two low-pressure are each 97 ins. diameter, the stroke in all cases being 75 ins. The crank and thrust shafts are 27 ins. diameter, the line shaft 26¼ ins. diameter, and the tail shaft 28½ ins. diameter; these shafts are all hollow, the two former having a 9-in. hole and the two latter a 12-in. hole therethrough. The revolutions per minute are to be seventy-five. Each wing propeller is 23 ft. 6 ins. diameter, and has a steel boss and three bronze blades.

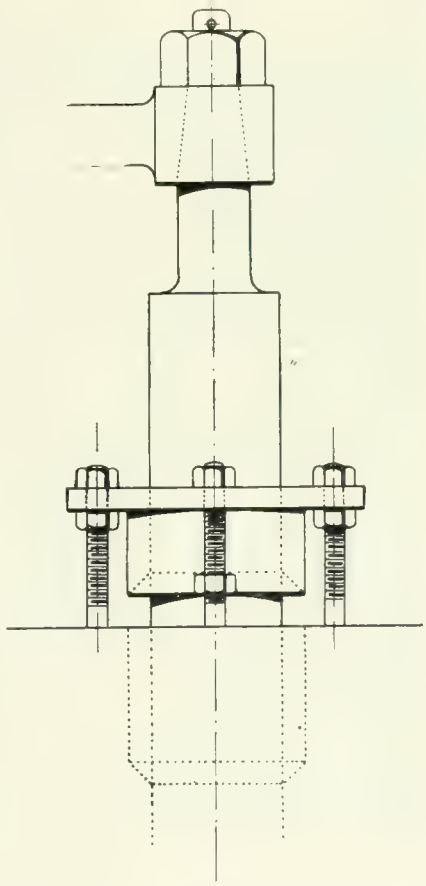
The exhaust steam turbine has a rotor 12 ft. diameter, the blades of which range in length from 18 ins. to 25½ ins., and the length of the bladed portion of the rotor is 13 ft. 8 ins. The turbine complete weighs 410 tons, of which 130 tons represents the rotor. The rotor shaft is 20 ins. diameter and the tail shaft 22½ ins. diameter, each having a 10-in. hole through it. The turbine is to run 165 revolutions per minute, and, working with steam having nine pounds absolute pressure, will develop 16,000 shaft horse-power. The propeller in this case is cast manganese bronze, has four blades and a diameter of 16 ft. 6 ins.

In order to give our readers some idea of the work involved in the construction of the *Olympic*, we illustrate a number of interesting features of the work, together with views of the actual launch itself.

PACKING ENGINE-DRIVEN FEED PUMP GLANDS WHILE THE ENGINES ARE RUNNING.

IN order to pack feed pump or bilge pump glands on engine-driven rams when the packing has been destroyed or worn out on a long voyage, it is, of course, advisable where possible to stop the engines in order to get as easy a job as possible. Engineers will, however, understand the trouble which this causes, quite apart from the necessity of working the steam off the boilers so that they will not blow off when the engines stop, which in turn involves upsetting the routine of firing and the "killing" of the fires, there is the trouble in the engine-room of shutting off evaporators, feed filters, feed heaters and other accessories. Yet another consideration, which is perhaps the most important of all, is that if a ship is stopped at sea the deck people begin to imagine all kinds of disaster, and commence talking about things which are not founded on fact and about which they know nothing. If this sort of talk circulates when the vessel reaches port, untold trouble may be caused; so that although inconvenience may be caused, it is never advisable to stop a vessel for minor repairs, however inconvenient it may be to do them with the machinery in motion.

The first thing to do when setting about re-packing the feed pump glands with the engines running is to clean the pump ram with paraffin so as to get rid of any hard grease; if this were allowed to adhere, the gland when raised in subsequent operation might seize on to the ram and either break it or become broken. The feed water should then be drawn from the hot well by means of the donkey feed pump, and



pumped into the boilers by way of the donkey check valve. The engine feed pump suction valves or cocks should then be shut and the pet valves eased. The nuts of the gland should then be slacked back to the end of the studs, and two opposite nuts should be screwed under the flange on the gland to keep it steady and prevent it from coming down upon the fingers when the packing is being inserted. Two opposite nuts will do for this purpose. The studs should be long enough to allow the gland to stand out of the stuffing box for the thickness of the packing when the nuts are slacked backed as indicated, and there should, of course, be no chance of the pump cross head coming down upon the gland when it is

UNITED STATES METALLIC PACKING.—Referring to the launch of the White Star liner *Olympic*, which is described in an article in the current number, it is interesting to note that the main engines, the electric lighting engines and the pumping engines are all to be fitted with United States Metallic Packing made at Bradford.

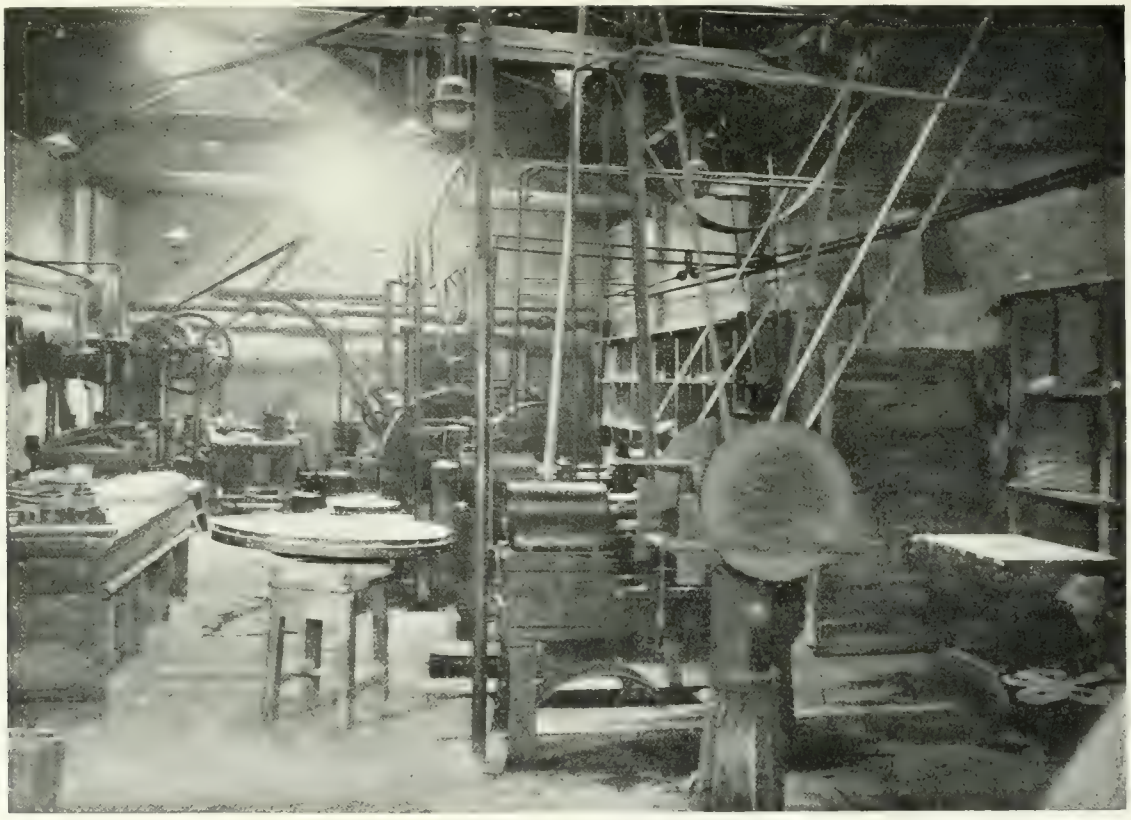
on the bottom of its stroke. When the gland is lifted up in this way the packing should be cut to length, nipped in the vice so that it will enter the stuffing box easily, and inserted turn by turn into the stuffing box. This, with a little care, can easily be done even if the ram is working, and when the packing is in place the nut can be slacked back and the gland adjusted. After the feed water connections have been changed over again the job will be finished.

THE BUILDING OF THE "THUNDERER."—Work is proceeding day and night to enable this battleship to be launched in December.

WE shall be inserting in our journal a series of articles on the Refrigerating Apparatus for Marine Transport (illustrated) which our readers will no doubt find interesting.

THE DERMATINE COMPANY'S WORKS.

THE subject of rubber and material appertaining thereto has been so prominently before the public recently that it becomes one of considerable interest, and a visit to the Dermatine Company's Works at Camberwell was suggested by these reflections. On our way we were reminded that Camberwell has associations connected with it well worthy of recall. While St. Paul's Cathedral was underway Sir Christopher Wren dwelt in the district. Oliver Goldsmith, while an usher in a school within the borough, met Samuel Johnson; Smollett, too, became acquainted with the future author of "Sweet Auburn," and secured him as a contributor to the "Monthly Review." Robert Browning, Tom Hood, elder and younger—the latter living till ninety-two years of age in the district, and William Black, novelist, are claimed as former residents. The Right Hon. Joseph Chamberlain was born in the Grove in 1836. The district is said to have received its name from a well, the waters of which were fruitful in healing the decrepit, and the patron saint Giles devoted himself specially to the care of such. In "Old and New London" there are many interesting details of the neighbourhood, the small official guide book (No. 501) published by Mr. E. J. Burrow and Messrs. Percy Lund, Humphries & Co., Ltd., also contains particulars of interest to visitors.

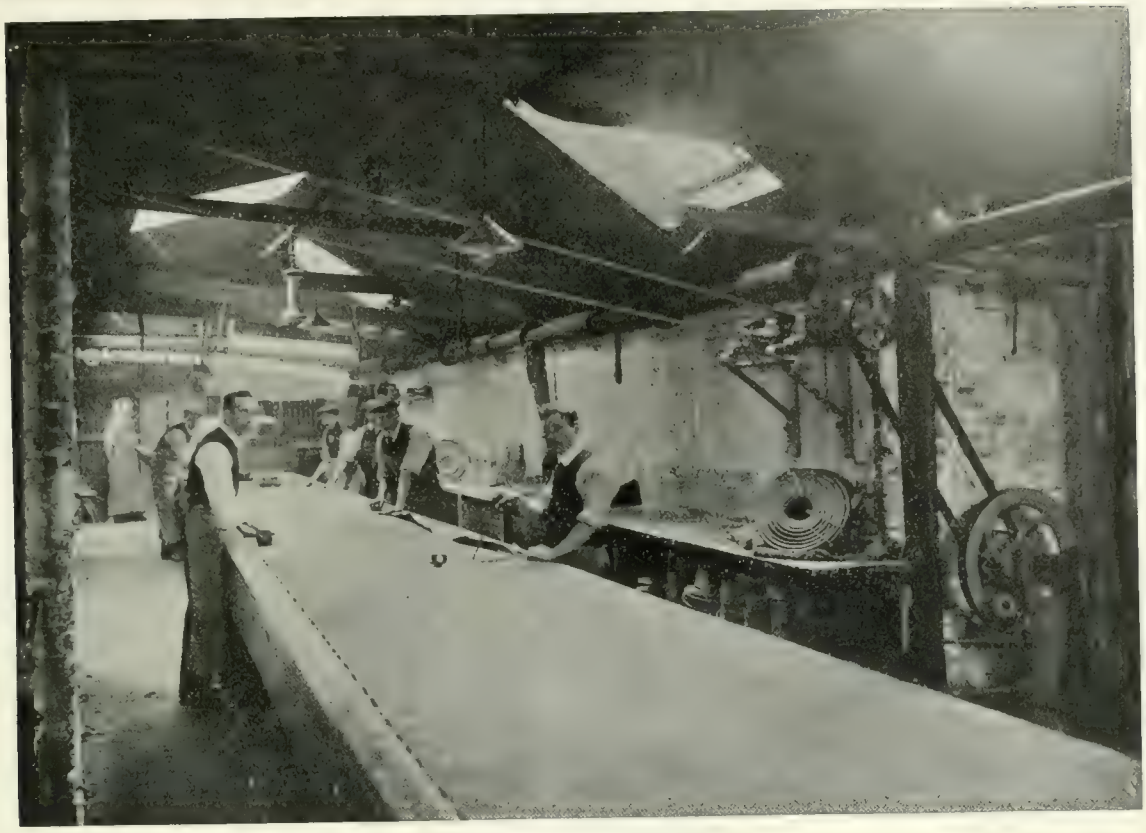


The Mill Room.

The works of the Dermatine Company are situated in the district of Camberwell, and from the appearance of the surroundings and the neat but unpretentious entrance from Neate Street, one would not expect to find the well-equipped factory it was our pleasure to visit.

Upon entering the factory after leaving the office premises, the manufacture of belting is shown in its various stages. It is of much interest, involving a good length of bench to carry the process through. The material is rolled to the required thickness and width, the edges and body are then stitched with several rows of good strong thread, to prevent

CONSTRUCTION OF NEW TRANS-ATLANTIC LINERS IN SPAIN.—One of the most important questions now being discussed in Spain is that of building ships for the maritime communications to be subsidized by the State. The Compania Transatlantica de Barcelona finds it necessary to repair and increase the number of its ships to comply with the new regulations made for the shipping lines. Amongst others it has been decided to acquire ten or twelve large trans-Atlantic liners to be built in Spain, or the greater number of them. This will involve the opening of a new shipyard or enlargement of existing ones, or both, and this question is now being considered in Bilbao by various large companies, such as Euskalduna Las Astilleros del Nervion, Altos Hornos de Vizcaya, Sres Sota y Aznar, Sr. Martinez Rivas. If this scheme is realized it will prove a solid foundation for the development of ship building on a large scale in Spain. This, together with the required new railways, will give new life to the iron and engineering industries.



The Belting Shop.

The Hose Shop.

lamination. Belts are all guaranteed as made from absolutely new material as a base, no old or second-hand ingredients being used in the process. Incorporated with the Dermatine is the best long staple flax for the warp and the strongest cotton duck for the weft in the manufacture of the belting, which is adapted for all kinds of works and all climates. They are specially claimed to be uniform in width and thickness, stand high or low temperature ; damp or steam ; are of great strength and longevity ; do not slip on the pulleys ; do not stretch or laminate.

The moulding shop next claimed attention, and here we see the process of making the special valves for air, circulating and other pumps, which the Dermatine Co. have placed on the market with great acceptance and grateful acknowledgment on the part of customers, both for the ordinary style and for the valves fitted with patent anchor bushes, the object of which is to strengthen the valve where the greatest stress and strain come, thus tending to its preservation at the stud hole where, if not protected by such means, is liable to split sooner or later. The different types of valves, whether direct or curved lift, as well as the different classes of work for which valves are used, whether for hot or cold water, for

Pneumatic Ear Pad for Loud-Speaking Naval Telephones.

acid or alkali, for oil or brine, have been carefully studied, experimented with and the peculiar features of each noted with a view to discover and supply the most suitable valve for each. The study appears to have been well repaid, and it is claimed that given the particulars for which reliable valves are required, the company can supply them. The curved lift valve is advocated in preference to the direct lift one, on the natural plea that the liquid being pumped through flows with greater ease and freedom, causing less disturbance of the current in the case of the former. Valve seatings, buffers, ball valves, Perreaux valves—two or three lip—bucket rings and Dermatine facings as inserts for metal valves, and other samples and specimens are made, moulded and cured to the required hardness or toughness for the special purpose to be served by each. The curing or vulcanizing is a process necessitating careful attention to these requirements.

Proceeding further through the works, we come to the spacious department for the manufacture of Dermatine hose. This, like the belting shop, is of considerable length, and contains the vulcanizing pan over 60 ft. long and the tray, when drawn therefrom, adds another 60 ft. to its length. The hose is made upon long iron tubes or mandrels, 60 ft. being the standard length. A solid layer of Dermatine covering the mandrel is the first operation, and this layer forms the inside lining of the hose. Plies of treated canvas are then pressed on with hand rollers until the hose has reached the required strength. Another layer of solid Dermatine is then added as the covering. It is then bound tightly round with cloth of fine texture, and placed in the tray of the vulcanizer. When the tray is full, it is run in on a tramway, and the contents are vulcanized. After the proper period of vulcanization has elapsed, it is taken out, the binding cloth unwrapped, and the hose is removed from the mandrel by means of compressed air, and is ready for use.

Dermatine hose is made for several special purposes such as withstanding the action of sea water, sewage, steam and for conveying liquids either under pressure or suction.

A considerable quantity of suction hose of 6 in. and 12 in. inside diameter was supplied in January, 1908, for raising the ill-fated steamship s.s. *Principessa Iolanda*, which sank in the Bay of Naples during the launching ceremony in December, 1907. Illustrations of the capsizing of this vessel was given in *The Marine Engineer and Naval Architect* of July this year.

Dermatine is largely gaining favour for use in the form of solid tubing for conveying acids, alkalies, etc., and among other goods made by the Company are packings, jointing rings for manhole doors, hydraulic ram rings, and pump cups, gauge glass rings, hat packings, canvas hose lined with Dermatine, hose for conveying carbonic acid gas for chemical fire engines, trolley wheels, carriage tyres, brake blocks and an article which specially interested us was a pneumatic ear pad which the Company make for Messrs. A. Graham and Co., the well-known Admiralty contractors, for use with the latest type of loud-speaking naval telephone.

The Dermatine Company cordially invite engineers to visit their works, a few hours' notice only being required. They also invite engineers to communicate with them with a view to carrying out any experiments they may wish to make connected with their profession, or the manufacture of any article not included in the catalogues.

INSTITUTE OF MARINE ENGINEERS.

AT the premises of the Institute of Marine Engineers on Monday, October 31st, the presidential address was delivered by Sir David Gill, dealing with "Accuracy of measurement and the metric system," after references to the increasing membership, the number and practical value of the papers and discussions which have formed a feature of the work of the current session and the various channels into which the enterprise of the executive has led them for the general good of the members, the Denny gold medal was presented to Mr. J. Clark (Leytonstone) for his paper on "Cylinder losses and adiabatic expansion of steam, with and without superheat." Awards were also presented to members in the junior section for papers sent in for competition, also to an apprentice engineer (open competition) for a paper on "The feed pump and connections, including the independent type, with descriptive notes on designs applicable to marine work," by Mr. G. Turner. The other prize-winners in the junior section are—Stephen award, Mr. James S. Gander, for "Notes on the propeller shaft." Ritchie awards—Messrs. C. V. Lewis, Robert Riddell and Walter Smith, for "Papers on the steam engine condenser."

The various meetings to be held in November in connection with the Institute are as under.

November 1st, nominations for office-bearers and members of Council for session 1911-12, to be received by this date. Each nomination to be proposed and seconded by members of the Institute, and to be further supported by at least three members. November 4th, annual dinner in the King's Hall, Holborn Restaurant, tickets 10s. 6d. each. November 7th, discussion on "Electro-magnetic transmission" and "The telemotor." November 14th, Fuel test. November 18th, Bohemian concert on the invitation of Mr. and Mrs. James Adamson. November 21st, "Indicator diagrams," by Mr. W. G. Winterburn (member). November 28th, discussion on Mr. Durtnall's paper "The internal combustion engine."

THE ENGINEERING AND MACHINERY EXHIBITION, MANCHESTER.

THIS exhibition opened on the 14th October at the City Hall, off Deansgate, does not close until the 5th of this month, and judging by the character of the exhibits, the position of the hall, located as it is at Knott Hill, one of the busiest centres of industry in the city, the interest taken and attendance of visitors, we should say it will continue to attract attention to the last moment. The building is full both on the ground floor and in the galleries, and many leading firms have taken space. We are not able to notice all of them, but near the main entrance is seen—

MESSRS. GEO. RICHARDS & CO., LTD., Broadheath, who show air compressors, a heavy boring and turning mill, a universal facing, boring drilling and milling machine, all being driven by electric motors. The air compressors are duplex single stage or single-crank two-stage machines.

MESSRS. JOHN HOLROYD & CO., LTD., Milnrow, Rochdale, show patent hob and worm-grinding machine, a slot drilling machine, a patent centring machine for turned shafts, a motor-driven grinding machine, a gear hobbing machine, screw milling machine, cutter grinding machine and 5 in. hack saw.

MESSRS. ANDRE CITROEN & CO., of London, exhibit a 16 to 1 single reduction gear on their system, a double helix having three sections for equalizing wear when reversing, and a set of bevel wheels 3 ft. diameter, for transmitting 60 h.p. at 130 revolutions. The gear runs quite silently, due to the shape of the teeth and their being machine cut. They also have a set of 12-in. rolling mill pinions and a 10-ft. spur wheel weighing three tons, and we are informed that Citroen gears have been adopted for the steering machinery of the *Olympic* and *Titanic*.

MESSRS. R. KLINGER & CO., London, show improved gauge cocks, water gauges and stuffing box packings, a cutting machine suitable for steam jointing, asbestos, etc., also specimens of the firm's well-known jointing.

MESSRS. W. H. BAILEY & CO., LTD., Manchester, have a pair of Davidson's boiler-feed pumps, each capable of delivering 5500 gallons an hour against 200 lbs. pressure, the same as supplied to the Prince line of steamers. Also seen here is a Köster air compressor and Foster reducing valve, stop valves, sight feed and mechanical lubricators, speed indicators, speed and pressure recorders, water meters and the usual run of steam fittings this firm make.

THE DEXINE CO., of London, show Warin's patent bucket for high duty feed pumps, H.P. jointing for superheated steam, Dexine gauge glass rings, which are said to be sold at the rate of 70,000 a week, and which do not melt or run down the glass or become hard. The firm have a considerable stock of their several specialities on their stand.

THE CAMBRIDGE SCIENTIFIC INSTRUMENT CO. have a new CO_2 recorder and an instrument for temperature measurements up to 3000°F., also seen is a mercury thermometer for superheated steam to register from 30°F. to 1000°. For low temperatures instruments shown are regulated so that there is no detriment when freezing. There is also an automatic temperature regulator for hot water and steam, and the Féry radiator pyrometer for registering from 500° centigrade.

THE CROMIL ENGINEERING CO., Newcastle, show Bambridge's patent flexible shaft, a feature of which is that when running the operator can start or stop where he is working and away from the power end, the motor always running, while by an automatic slipping arrangement it is impossible for an overload to take place. Three speeds with one pulley are afforded by a very simple mechanism. Seen also on this stand are a valve reseating machine, various types of hand shapers and a dry graphite lubricator. We noticed also cork coverings for pipes made in sections and various packings.

THE HOYT METAL CO. show Hoyt's standard babbitt or anti-friction metal in various qualities, to suit every class of requirement, it being claimed that the metal is made from new material and of perfect homogeneity. The Hoyt die-casting machine is seen for casting solid bearings with oil grooves complete and requiring no further machining of any kind.

MESSRS. HENRY PELS & CO., London, show for the first time a machine for shearing joists and channels through at one stroke. The machine has a steel-plate frame for lightness. It shears joists 12 in. by 5 in. in ten seconds. Seen also are the usual hand-punching, shearing and cropping machines, which are useful for taking from one part of a shipyard to another, and a machine seen here shears and punches at opposite ends and crops in centre and on any section without change of blade. A stop motion enables all three operations to take place at once, or each independently. We may be able to notice the first of these machines specially later on.

THE PATENT FILE AND TOOL CO. show the Dreadnought files which have the merit of self-clearing and a guaranteed life of double an ordinary file. By a file-testing machine a record is shown on a chart of the rate of cutting. In a re-sharpening machine it is seen there is no effect by the operation on the temper of file.

THE GLACIER METAL CO. show specimens of white bronze, which is recommended for thrust and big end bearings. A fibrous metallic packing for glands and stuffing boxes seen on the stand is used on the largest ocean-going steamers, trawlers and works of various kinds.

MESSRS. PRINCEPS & CO., Sheffield, exhibit R. & H. restrained piston rings to prevent undue wear on the cylinder walls. In a double action piston ring lateral and diametric expansion is allowed for, while a patent wedge metallic packing gives a universal grip of the rod by springs acting through a system of inclines. These are said to be used extensively on large shipping lines.

THE COMBINATION METALLIC PACKING CO. display Robson's forced feed lubricator, for use at pressures of 200 lbs., and if sight-feed glass is broken the operation of the pump is not suspended. In Robson's stop and drain valve all condensed water is removed, which obviates water hammer or the usual practice of blowing through. The firm's metallic packings for rods are fitted to numbers of recent vessels built. A feature is that these will work for years without inspection, and are described as very efficient for superheated steam. The C.M.P. steam whistle control automatically drains the valve, and so prevents moisture escaping when in action. The C.M.P. jointings for manhole and mudhole doors give the advantage that they can be used on a rough surface and repeatedly.

MESSRS. CLARKE, CHAPMAN & CO., Gateshead, have a model of Woodeson's patent water tube boiler, a feature of which is the vertical straight tubes provided for giving easy release of steam. Also seen here are Admiralty strip resistances for all classes of electrical work, the stand being replete with photos of all classes of auxiliary machinery, and for which the firm is well known.

MESSRS. WALLACH BROS., LTD., show the Pat valve, in which there is no stuffing box and a full bore is given. These are tested to 250 lbs. pressure and are self-clearing and self-grinding without any effort on the part of operator. Besides jointings for high-pressure steam we saw here an electrical drilling machine, which will not burn out when overloaded, and no cut-out is necessary.

THE STERN SONNEBORN OIL CO. display samples of oils, greases and lubricator belting bricks and Sternoline tunnel bricks, which are said to be used on mail boats and in the merchant service.

THE ROSSENDALE BELTING CO., LTD., show a 132 ft. long by 40 in. wide $\frac{5}{8}$ in. belt to transmit 600 h.p., also a coal-conveying belt which can be manufactured up to 72 in. wide and is used by the largest collieries. Their M.A.V. belts for heavy driving are shown, also samples of hair and leather belting.

MESSRS. J. F. COATES, Manchester, exhibit an 18 ft. clinker boat fitted with 2 h.p. engine and solid propeller; also eight marine internal combustion engines of the Ajax type. These are 2-stroke engines, an air buffer being introduced between ingoing gases and the hot exhaust, by which it is claimed there is 15 to 20 per cent. economy. The piston on the engine operates as a valve, covering and uncovering ports in the cylinder walls. A Simm's magneto is used, and reversing is in some cases by a gear box and in others by reversible blades.

MESSRS. SCHAFFER & BUDENBURG have a run of their well-known gauges, steam pressure and vacuum recording gauges, control watches for checking workmen's time, mercurial vacuum gauges and barometers, boiler water gauges, and the latest type of gauge glass protectors, steam whistles and combined tachometer and pressure recorder, engine counters

and auto callipers, also an electrical pyrometer for recording in an engineer's cabin the temperature of boiler flues.

MESSRS. SNOWDON, SONS & CO. show metallic packing for steam and water, also their Snowdrift and Sinol lubricants, as well as mechanical and automatic lubricators.

MESSRS. JAS. WALKER & CO.'S stand is near the main entrance, on which is seen the well-known Lion expanding steam packing, their various metallic packings, golden Walkerite jointings and Wallico cones and gauge glass rings.

MESSRS. ISAAC STOREY & SONS, LTD., show two direct-acting boiler feed pumps of new design, and fitted with patent differential valve gear, a combination claimed to be more economical than the usual types of gear, and which we may be enabled to describe more fully later on. An automatic boiler feed regulator is seen here, which is said to give first-class results and keep the water level always within ½-inch without any attention. We saw also a set of motor-driven air pumps for condensing plant, also a collection of the firm's well-known specialities in valves and fittings. Many firms whose names are well known are exhibiting, but we have endeavoured to select those which have most interest for our readers, and we can only repeat that at the time of our visit the exhibition bade fair to have a considerable success before it.

INSTRUCTION IN "FUEL."

By Mr. J. S. S. BRAME.

THE inaugural lecture of the courses of instruction in "Fuel" was given by Mr J. S. S. Brame, lecturer on fuel at the Sir John Cass Technical Institute, on Monday, October 10th. The subject of the lecture was "Power Gas and its Development." The chair was taken by Professor F. Clowes, D.Sc., past president of the Society of Chemical Industry, who, in introducing the lecturer, pointed out the technical importance of the modern developments of power gas, and referred to the value of the instruction that is provided at the Institute for the study of the applications and analytical examination of all forms of fuel.

Mr. Brame pointed out that the introduction in quite recent years of power gas, whereby the heat units available in our fuels are converted into work without the intermediary of the steam engine, has been a factor of immense economical importance and the extension of this method of applying our fuel will, in the near future, exercise an even greater influence in reducing the cost of power and thus enabling us to conserve our vast, but nevertheless limited, supplies of coal.

The total coal production for 1909 was 263,758,000 tons, and our annual home consumption some 180,000,000 tons. It is difficult to estimate how this consumption is distributed, but we may roughly compute that 45 millions are utilized for power purposes, 20 millions for blast furnaces, whilst some 17 millions are carbonized for the production of gas It is unlikely that the consumption in gasworks will decrease, but the introduction of the large gas engine is rendering much of the available power from blast furnace and coke-oven gas—equivalent to some 1,250,000 h.p. per day—of service, thus leading to very considerable fuel economy; indeed, one English firm is saving about £1000 per week on these lines, and on the continent the Differgingen Iron and Steel Works effect a fuel saving of £75,000 in the year.

It is to the demand of coal for power purposes that we must turn to realize the economies which are possible through the introduction of power gas. As compared with the steam engine the consumption of coal per B.H.P. is practically one-half, and if we could reduce our coal consumption by nine million tons by substituting power gas a national saving of 20 per cent. on the coal used for power would be effected. Further, the power gas plant is rendering economically available for power purposes immense stores of fuel which could not otherwise be applied. One ton of dry peat, for example, yields some 1,000 B.H.P. per hour, together with from 70 to 200 lbs. of sulphate of ammonia, worth £11 to £12 per ton. When it is remembered that in Europe there are some 140 million acres of peat bog, often 14 to 16 feet in thickness, the utilization of a small portion of the energy here stored up would effect a large saving of coal for other purposes.

The possibilities of power gas are being rapidly recognised, as is evident by the enormous advances made in its introduction in large and small works in recent years. Where gas for heating purposes as well as power is demanded, it offers so many advantages that its installation into steel works, shipbuilding firms and similar industries already amounts to many thousand horse-power.

As regards fuel costs, the efficiency of power gas is approximately 20 per cent., whilst with steam 9 to 10 per cent. is a fair average.

An outline of the general principles underlying the action of gas plants was then given and the general arrangement of plant illustrated, the various forms of pressure plants and suction plants being described.

For small powers suction gas is not a competitor with pressure gas from bituminous fuels, since gas plants using this class of fuel are unsuited for small powers by reason of their higher first costs and working charges.

The pressure plants for non-bituminous fuels offer great advantages where gas is required for heating in addition to power. Pressure gas is usually somewhat richer than suction gas and is more uniform in composition, since its production is continuous whilst the latter is intermittent. Pressure systems usually are provided with a holder which enables more uniform gas to be stored, supplies good gas to the engine after a stand-by or working on light load, and enables gas to be distributed to several engines and to furnaces for heating.

On the other hand, for small power plants only, up to some 250 h.p., the suction gas plant offers so many advantages, such as compactness, low cost, simplicity of working, that its rapid introduction throughout all countries is easily understood. Hitherto the choice of fuels has been limited to anthracite (the demand for which has greatly raised the price) and good quality coke. The use of bituminous fuel with its manifest advantages in the matter of supply and price has, until quite recently, been impossible, owing to the difficulty of removing the tar from the gas, but practically all the leading makers now supply suction plants which it is claimed work well with such fuels, the general principle involved being the destruction of the tar by causing the distillation products from the coal to be drawn through the hottest zone of the producers where the resulting coke is being gasified. In Germany suction plants working on fuels containing sufficient moisture for the producer reactions—lignite, peat, etc.—have been successfully employed.

In comparing the relative merits of coal gas and suction gas for small power plants, detailed estimates of cost were given, which showed that little advantage is obtained by the adoption of suction gas when cheap town gas is available, what little gain there is being quite counterbalanced by the conveniences arising from town gas supply and total absence of stand-by charges. Above 30 h.p. the advantage of suction gas, however, rapidly increases.

The success of the suction plant working on bituminous fuels even of the most unpromising character is now established, and the extension of the use of this type of plant is likely to be very rapid. Systems of scrubbing the gas will be improved when it is realized that such a process is essentially not a filtering one. The utilization of the exhaust from the engine in lieu of steam through the producer has given promising results, the poor quality of gas being more than counterbalanced by the higher compressions possible in the cylinder. The abolition of the gas holder where pressure gas is required for power purposes only and the control of production according to demand by fans automatically working with the engine is almost universal in German practice.

INDIA RUBBER.—It has no doubt been a relief to many users and manufacturers to see a lowering in the price of rubber. It seems especially hard upon both that prices reached so abnormal a stage when the cost of production appeared to be small enough relatively, even to the former prices, to yield good profits to producers or shareholders. The insane rage which recently afflicted the many, and brought not a few into financial difficulties, and some, it is true, into affluence, led to very trying conditions in the market which has been gradually returning to a more normal state, so that it may be hoped the large percentages added over former prices on accounts may be reduced permanently.

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

The Amalgamation of Fleets.

ANOTHER Company has just been absorbed by the great Hartlepool firm of Messrs. Furness, Withy & Co., The Norfolk & North American Steam Shipping Co. (registered in December, 1893, with a capital of £200,000, of which £127,750 has been paid up) being purchased at a price of 8/- for each £ share, payment to be made in five per cent. cumulative preference shares of the absorbing Company. The offer was made conditionally on at least one-half of the capital in the Company accepting the offer of Lord Furness, who also insisted on the termination of the arrangement between the Company and its present managers. This latter stipulation was, of course, made in order that the fleet might come under the direct management of Messrs. Furness, Withy & Co. The vessels which will be transferred are :—

	Year built.	Place of building.	Builders.	Gross tonnage.
Crown Point ..	1900	Sunderland	J. L. Thompson	5,219
Eagle Point ..	1900	Sunderland	J. L. Thompson	5,222
East Point....	1901	Sunderland	J. L. Thompson	5,254
Montauk Point	1890	Newcastle	R. Stephenson	4,822
North Point ..	1900	Sunderland	J. L. Thompson	5,216

Messrs. Furness, Withy & Co. are also credited with important plans concerning the trade with Argentina, it being said that they are about, in conjunction with the Royal Mail Steam Packet Company, to start a line of steamships with large refrigerating space for the conveyance of chilled meat from the River Plate. These steamships are to serve not only British ports, but also several on the Continent, including some in the Mediterranean and the Baltic.

The Royal Mail Steamship Company,

though meeting with discouragement in official quarters as to its West Indian Mail services, is bent on breaking fresh ground in other directions. Besides its arrangement with the Furness Line, it has entered into one for the further development of the Bermuda trade—in which, if I remember rightly, it last season placed one of its more important passenger ships during the press of the tourist traffic. It has now arranged with the Quebec Steamship Company for the maintenance of a regular service between New York and Bermuda. New York indeed will apparently assume a large importance for the future in its itineraries, especially if no arrangement with the British Government and Post Office be reached.

An interesting announcement

has been made in the shipping press as regards the future policy of the Hamburg-American Line in its North Atlantic passenger trade. The vessels which it has recently placed in the New York trade have been large and luxurious ones with a moderate speed at sea. Their express steamer *Deutschland* has, therefore, stood alone. Experience with other Companies—notably the old National Steamship Company with the *America*, and the Anchor Line with their sailings of the *City of Rome* from Liverpool—has shown that the public does not care to book by a steamer of high speed, if there are not opportunities of returning at more frequent intervals than one steamer alone can afford. So it is said that the *Deutschland* is to be diverted into the public yachting business. The Hamburg-American Line has considerable experience in this sort of co-operative travel, and for some years has devoted a large twin-screw vessel to this service. It is now said that the present public yacht, the *Oceana*, is to be withdrawn, and that the *Deutschland* is to take her place.

Comparative details of the two ships may be of interest.

	Deutschland.	*Oceana.*
Gross tonnage	16,502 tons	7,859 tons
Length	660·9 ft.	531·0 ft.
Beam	67·3 ,,	54·8 ,,
Depth	40·3 ,,	33·7 ,,
Engines.. ..	Quadruples, 12 cylinders	Triples, 6 cylinders
Built	1900 at Stettin, by the Vulcan Co.	1891 at Dumbarton, by Denny's.

The *Oceana*, which was built as the *Scot* for the old Union Steamship Company, and which made so great a reduction in the time of the passage between Southampton and the Cape, was lengthened by Messrs. Harland & Wolff at Belfast in 1896.

The Booth Line

is about to inaugurate a system of regular sailings from Para to the River Plate, there being, it is said, a movement of third-class passenger traffic in that direction. Moreover as cargo is scarce in Brazilian ports at the moment, it will enable the steamers which carry on this service to fill up for Liverpool at Buenos Ayres. It is also announced that the Houston Line is about to increase its attention to the Plate trade.

The White Star Line

has announced that it will abandon its call at Holyhead with its Liverpool passenger steamers. The trial of the advantages of Holyhead as a port of call have thus extended over the best part of two passenger seasons. During the season of 1909 it was tried as an outward as well as an inward station, but one season's experience satisfied the managers that the outward call at least was of no advantage. Now they have reached the conclusion that in neither direction can a stay be usefully made there.

With a view to the advent of the great White Star liners *Olympic* and *Titanic* to the Southampton and New York service, there have been ordered from Messrs. Harland and Wolff two passenger tenders of 200 feet in length. Perhaps the most interesting portion of the intimation is that which states that there is a possibility that one of the pair will be constructed at the Company's Southampton works, which hitherto have confined their activity to repairing jobs. The matter is, however, evidently as yet quite undetermined, as another report states that three vessels—two of them being these same tenders—are to be laid down on the slip at Queen's Island vacated by the launch of the *Olympic*.

The Rush of New Passenger Steamers

is really remarkable. We have the White Star adding the *Titanic* and *Olympic* to its fleet, Cunard's building the *Franconia* and *Laconia*. The Compagnie Générale Trans-Atlantic have just had launched for their express service to New York the turbine-engined steamship *France ;* not only the biggest vessel of the fleet, but the biggest ship ever built or registered in France—she is a vessel which will cost considerably over a million francs ! A million francs is only £40,000. Yet the daily press absurdly puts down the cost at this ridiculously inadequate figure. The Hamburg Company is building several vessels, including the Stettin Leviathan, which is to eclipse in size even the new White Star liners. The Nelson Line is building a whole fleet for its chilled meat trade from Argentine. The Royal Mail Steam Packet Company is said to have just ordered five large steamers for the Pacific Steam Navigation Company—the purchase of whose share capital it has recently completed ; of these vessels some are to be built at Queen's Island and some on the Clyde. The Aberdeen Line is replacing the *Pericles* with the *Themistocles* and is adding another ship to its fleet. The P. & O. is adding two new vessels, to be called the *Ballarat* and the *Bendigo*, under construction by Messrs. Barclay, Curle & Co., to its newly-acquired Lund Line branch, whilst the details of the two new mail steamers *Medina* and *Maloja*, building by Messrs. Harland & Wolff and Messrs. Caird & Co., show that they will be far the finest ships yet constructed for the fleet. They will be 1 500 tons larger than any previous vessel, having a length of 550 ft. by 62 ft. 6 in. beam and 39 ft. 3 in. depth. Their gross register will be 12,500 tons and they will be most luxurious in their accommodation, fulfilling the new want on the part of the travelling public—privacy. They will have a number of single-berth cabins. The smoking-rooms will be on the promenade deck, and there will also be verandah smoking-rooms.

The Bibby Line have completed their new ship the *Gloucestershire*, which is appointed to leave the Mersey on her maiden trip to Rangoon on the 2nd November.

The "Balmoral Castle,"

as a King's ship, left Portsmouth on her history-making voyage on the 11th October with the Duke and Duchess of Connaught, their family and suite. Great alterations seem to have been made in the vessel to adapt her for the special service on which she is engaged.

Electric Fans in State-Rooms.

The Judge of the City of London Court gave another of his extraordinary judgments in the case of Eck v. the Union Castle Mail Steamship Company at the end of September. It appears that the plaintiff took his wife and daughter to South Africa by the defendants' line on return tickets. Before taking the passage he read a handbook issued by the Company. Here are contained the words —" the question of ventilation has been very carefully studied and a most complete system has been adopted. Electricity is brought to bear on the cabins, sleeping saloons, etc., by the adoption of a large number of electric fans." On the return journey the wife and daughter complained that their cabin on the *Avondale Castle* was insufficiently ventilated, and Mr. Eck got them another room, paying £4 12s. 6d. for the change. This sum he sought to recover from the shipowners on the ground that in view of the words quoted from the handbook they had been guilty of breach of contract. Judge Rentoul said that the words in the handbook seemed to him to bind the Company to have an electric fan in every cabin in every steamship of their line. This is by no means the grammatical meaning of the words. But that being his view, he, of course, found in favour of the plaintiffs, though how he could possibly arrive at such a reading of the sentences quoted passes the comprehension of every one who is not a judge of the City of London Court. As he expressly refused to allow an appeal the decision stands, but a good deal of sympathy will be felt with the defandants, who have suffered a very unmerited slur. Fortunately the Union Castle Line's reputation stands too high to be affected by such a decision as this.

Mr. Thomas Boumphrey,

sometime general manager of the Cunard Company, and the man who gave the idea of the Riverside Station at Liverpool, died at the close of September. He had lived in retirement in Liverpool since he gave up his position with the Cunard Line some fifteen years ago. The idea of utilising the Waterloo goods tunnel for passenger traffic was as simple as it was clever, and it may well be said that by making it possible for Liverpool Liners to offer train to boat facilities to American passengers he gave a new lease of life to the North Atlantic passenger trade of the port.

Another important absorption

is that of the Elder & Fyffe's Company by the United Fruit Company of Boston, which has recently been announced. Messrs. Elder & Fyffe's have, during the last two years, disposed of four vessels from their fleet, but, including small craft, they still have a dozen vessels left.

The "Kaiser Friedrich."

That unhappy steamship, which appeared as though she would at last find employment in the new trans-Atlantic service of the Norwegian-American service, is again on the market. On consideration the purchasers seem to have thought it unwise for a new line with a comparatively small capital to embark so large a portion of its assets in a single vessel. Especially foolish would they have been to have placed it in a ship which, from her size and speed, would necessarily have been a most expensive vessel to run.

The "Lancing."

A paragraph has gone the rounds of the shipping press telling how the four-masted Norwegian ship *Lancing* has made two smart runs across the Atlantic, coming home from the Gulf of St. Lawrence to Ardrossan in thirteen days. It is interesting to note that this ship was built as the steamship *Pereire* for the Compagnie Générale Transatlantique. She is no less than forty-four years old. But she came from the famous Glasgow yard of Messrs. R. Napier & Sons.

Messrs. Palmer's and Robert Stephenson's.

The report that the Palmer Company is about to take over the Stephenson business is of great interest, for the two yards are so situated as to easily be worked under a single control, whilst the union would give an added weight to the important Jarrow Company, which would no doubt find the great dry-dock useful to it in regard to the construction and repair of ships of the first-class. The idea seems to be to separate the work of building naval ships from that of constructing merchantmen, the former being undertaken in future at Jarrow, whilst merchant-vessels alone would be built at Hebburn. But it is too early to discuss details of this kind. We have yet to make sure thatthe amalgamation will be carried out.

LIQUID FUEL.

ONE of the more important industries connected with engineering is that of liquid fuel for all kinds of marine and land use. In view of the influences now at work, the industry will certainly be assisted in the great strides it is making, and a great cheapening of oil fuel should result, with a consequent increased demand for oil fuel systems.

The *Lusitania* and *Mauretania*, it is computed, burn about 1000 tons of coal per day. It is estimated that about 10,000 horse-power is lost per trip, due to cleaning of fires and tubes, besides all the expense of bunkering coal and large stokehold staff. With the adoption of oil fuel a pipe line would connect the depot with the oil tanks on board. The existing machinery could be readily adapted to the liquid fuel, and a great saving of bunker space effected, thus giving more room for cargo. Oil depots are on the increase, and already established at many British and other ports, besides the Admiralty depots.

During the past year the price of this commodity has fallen about 30 per cent., and the present oil war must still further reduce the cost. Its adoption by various companies who contemplate the building of large vessels is persistently rumoured, and in these days of competition and speed its selection must be merely a matter of time.

The "Kermode System of Liquid Fuel," whose offices are in Liverpool, state that their system has been adapted and supplied to all kinds of land and marine purposes, and at present they have projects in hand for marine work for over 80,000 horse-power.

Messrs. Vickers, Sons & Maxim, of Barrow-in-Furness, have just placed an order with them for an installation for a ship for the Imperial Chinese Navy.

The latest reports from Canada are to the effect that steamers on the Pacific coast that use coal at present are to become oil burners. The advantages to Naval ships, such as quick raising of steam, absolute regulation, smokelessness, greater power for weight and other special features, are too well known to need mention.

REVIEWS.

Reed's Extra First-Class Engineer's Guide Book. Sunderland: Messrs. T. Reed & Co., Ltd. 18/- nett.

THE Honorary or Extra Certificate granted to engineers who devote themselves to study a more advanced course than is required for the necessary certificates showing competency to take responsible charge of machinery, is one which all engineers would do well to consider as worthy of attainment, not only as a possession for its own sake, but for the mental training which the requisite study for it involves. At the outset, it is pleasing to note that in this volume emphasis is laid on the advice, which all true well-wishers of education will endorse heartily, that cramming should be avoided in preparation for an examination. The various textbooks which the student should have beside him while reading up for the examination are named, and the leading lines on which the study should be conducted are stated in concise terms, so that the engineer who has a desire to obtain the certificate can at once see what lies before him, and receive at the same time encouragement to devote himself to the task. The official regulations setting forth the qualifications

and subjects of examination are quoted for the guidance of prospective candidates, and a summary of the work to be done in the course of preparation is given; the laws of gravity and motion, statics, theory of stress and strain, beam problems, strength of shafting for marine engines, heat, combustion, boiler designing and working, theory of propulsion, rules for wetted surface of ships, and laws connecting wetted surface and speed in different types of boats, theoretical naval architecture, and miscellaneous problems. Lest any candidate should desire only to devote himself to the immediate letter of the examination, the paragraphs in the guide that do not necessitate the attention of such are enclosed in lines, within which the student unwilling to enter need not do so; but the information is there for those who seek to enter and possess the land in a fuller sense, and for this class of student there is every encouragement given, a most commendable feature of the guide. The exact meaning of terms is clearly expressed in connection with the problems, of which there are 374, fully worked out, explained and answered. These problems are so clearly expressed and most of them bear so closely upon what every marine engineer ought to know, that by carefully following the arguments of the author, the engineer who has a regard for his own standing will be a gainer by devoting himself to a study of the Guide, even should he not have the intention of aiming for the extra certificate. Many of the problems remind us of the happy irresponsible school-days that are gone, when mathematics, statics, trigonometry and physics held us entranced—lest we should suffer worse things—and we hail them with a friendly eye, while we commend this guide to the attention of all marine engineers. There are appendices A, B, C, D, E and F, embracing the elements of algebra, logarithms, hyperbolic logarithms, trigonometry, the calculus and tables of saturated steam. There is a very useful detailed index at the end of the book. A set of seventeen clear plates in a portfolio is included with the Guide, showing many of the details of main and auxiliary machinery; two of the plates show how to lay down a drawing of a propeller, right and left-handed, with either a true or a varying pitch.

OBITUARY.

David Anderson.—The death occurred on October 12th at his residence, Crosshill, Glasgow, of Captain David Anderson, who until last year was marine superintendent of the City Line of steamers, which line he joined so far back as 1869. Captain Anderson, who was seventy-one years of age, was born in Johnshaven, near Montrose, where his father was a shipowner. He first went to sea in his father's sloop *Farmer*, and in 1859 he joined the City Line as an A.B. He was promoted first mate in 1863, and in 1864, when he was only twenty-three years of age, he was appointed master of the City of London. His first steamer was the *City of Mecca*, to which he was transferred in 1874. The vessels under Captain Anderson's command traded with India, and during his long association with the City Line he became one of the best known and most popular captains. In 1895 he left the sea and became marine superintendent of the City Line, his duties being on shore. He was a nautical assessor under the Board of Trade, and in that capacity sat with the Sheriffs in a number of Board of Trade inquiries. The age limit compelled him three years ago to resign the position, which he had held since 1896. He retired from the City Line in September, 1909, and on that occasion he was the recipient of presentations from the owners, the captains and officers and the office staff.

John Buchanan.—The death occurred at Glasgow, on October 12th, from a heart affection, of Mr. John Buchanan, one of the directors of the Buchanan Steamers, Ltd., a firm which has been connected with the steamer sailings on the Clyde since 1852, when the deceased gentleman's father inaugurated the Buchanan steamers. Mr. John Buchanan qualified as a marine engineer, and at the age of twenty sailed in one of the Union Company's liners for New Zealand. He was connected with the New Zealand trade for ten years, and eighteen or nineteen years ago he settled in Glasgow. Becoming a director with his brothers in the firm, he took an active part in the development of the business. Mr. Buchanan, who was about fifty years of age, is survived by a widow and family.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our Own Correspondent.)

DESPITE the fact that the iron-working sections of the shipyard operatives were locked out from September 2nd, the output of shipbuilding from Clyde yards has been maintained at almost the normal standard, although the effect of the stoppage will not be fully felt until later. During September the output reached to more than the average monthly figure, and was, in fact, the second best for the year. The number of vessels launched was twenty-three, their combined tonnage being 46,950. This is some 5,500 tons better than the output of August, and well ahead of all other monthly outputs, with the exception of April, when the figures were twenty vessels of 56,420 tons. The total output for the nine months of the year amounted to 226 vessels of 342,630 tons, which is an advance on the output during the corresponding nine months of last year, of sixty-two vessels and 74,180 tons. The statistics for October have not yet been made up, but the returns will make a very small figure and the output for the remaining months of the year must sharply rise if 1910 is to take its legitimate place in the general upward trend of the industrial cycle.

Shipbuilding operations on the East Coast of Scotland yards, on the Forth, Tay and Dee, were for some months prior to the lock-out experiencing great depression. Just prior to the lock-out troubles, however, there had been in the matter of fresh work a return to normal activity, and additional new work in prospect. During July, August and September no launches whatever took place in yards on the Tay, and during July and August none from the Forth. Launches on the Dee, on the other hand, have been plentiful during the third quarter of the year, as many as seventeen vessels of 6,900 tons having been sent off the stocks. The output of the three rivers for the nine months of the year reached a total of sixty-two vessels of 22,750 tons. The average tonnage of the vessels launched from yards on the Dee during the third quarter was as small as 383 tons, accounted for by the large majority of the vessels being of the trawler and drifter class. A very notable exception indeed to this order of things falls to be recorded of the Dee production during September. On September 6th Messrs. Hall, Russell & Co., Aberdeen, sent off the stocks the steamer *Intaba*, built to the order of Messrs. John T. Rennie & Son, Aberdeen, intended for their passenger and cargo service between London and Natal, whose length is 401 ft. and tonnage 4,700, a figure almost exactly equivalent to the whole previous month's output of the Dee. This vessel is the largest steamer ever launched at Aberdeen.

New Naval Contracts.—Of the five second-class cruisers of the "Yarmouth" class which have now been given out by the British Admiralty (three of which are intended to form units in our Colonial Fleets), three have been ordered from Clyde firms: one from Messrs. Wm. Beardmore & Co., Ltd., Dalmuir; one from Messrs. John Brown & Co., Ltd., Clydebank, and one from the London & Glasgow Shipbuilding Co., Govan, the remaining two having been placed with English builders. These ships will be similar to the "Yarmouth" class, one of which, the *Falmouth*, was successfully launched from the works of Messrs. Beardmore & Co. early in September. All the successful contractors in this case have built, or are building, vessels of the same type. Like their predecessors, they will each be of 5,500 tons displacement, and will have turbine engines of 22,000 I.H.P. In the case at least of the vessel ordered from the Clydebank firm, the turbines will be of the Brown-Curtis type, which have proved themselves in the case of the cruiser *Bristol*, recently handed over to the Admiralty, conspicuously successful. While each of these vessels will cost about £350,000, most of the large firms who undertake the heaviest class of naval work are anxiously looking forward to the settlement of contracts for three huge armoured ships involving vastly greater expenditure. Two are to be battleships similar in size and design to the *Conqueror*, building at Dalmuir, which has a displacement of 22,000 tons, and will carry ten 13·5 guns, and the third vessel is a fast cruiser of the "Lion" class, the greatest and fastest war vessel yet built. For these important contracts five

Clyde firms are competing, namely, Messrs. Scott & Co., Greenock; Messrs. Beardmore & Co., Dalmuir; Messrs. Brown & Co., Clydebank; the Fairfield Shipbuilding and Engineering Co., Govan; and the London & Glasgow Shipbuilding and Engineering Co., Govan. Quoting with the Clyde firms for this important work are five English firms, but there is a reasonable confidence in the contract resulting in the Clyde securing one at least of the three £2,000,000 ships.

Clyde Torpedo Factory.—Torpedo-making may now fairly be considered an established Clydeside industry, and incidentally the association of the Scottish river with British Admiralty affairs is made of a still closer character. The extensive works erected by the Admiralty on the shore at the Battery Park to the west of Greenock are now partly in operation, work at present being confined to the 21-in. torpedo, the largest in use by the British Navy. The transfer of workers from the Royal Arsenal at Woolwich is being effected gradually, parties of men and their families having been brought to Greenock just in proportion to the progress of the new factory towards completion. In all, the total transference to date comprises 528 adults and 144 children. Notwithstanding this, it is understood that the staff remaining at Woolwich is still sufficient to carry on the work there without very much decrease in the output.

Shipbuilding for Foreigners.—The building of ships for foreigners in the several British centres is fast becoming a rare if not a lost branch of the shipbuilding industry. On the Clyde, however, two vessels of large dimensions and high-class character are being completed to foreign order. One is the *Kursk*, built for a Russian company, by Messrs. Barclay, Curle & Co., Whiteinch, and the other is the *Preussen*, built for the Hamburg-American Co., by Messrs. John Brown and Co., Ltd., Clydebank. She is a cargo steamer of about 8,000 tons, having a deadweight capacity of about 12,000 tons. A goodly-sized steamer is now being engined at Dundee owned by a Scottish Company but the hull of which was built in Holland. A contract just made for another cargo steamer by a Glasgow shipowning firm is a curiously international affair, the vessel being for Glasgow owners, but ordered through a London agency from a Dutch firm of shipbuilders, and the engines for which are to be made and supplied in South Shields. The vessel is to carry about 2,000 tons deadweight, and is to be ready for delivery in the spring.

Messrs. The Fairfield Co., Govan, and Messrs. John Brown and Co., Clydebank, have each received from the Royal Mail Steam Packet Co. an order for a steamer of 10,000 tons (of which five in all have been ordered, three going to Messrs. Harland & Wolff, Belfast), which are those required in connection with the amalgamation of that line with the Pacific Steam Navigation Co. and the railway extensions in South America.

Messrs. Wm. Hamilton & Co., Ltd., Port Glasgow, have contracted to build two shelter-deck steamers, each of about 6,500 tons gross, for the Stoomvaat Maatschappi Nederland of Amsterdam. The engines for the vessels will be supplied by Messrs. Dunsmuir & Jackson, Govan, the contract speed being 13 knots.

Messrs. A. Rodger & Co., Port Glasgow, have received an order from Messrs. Easton, Greig & Co., Glasgow, to build a steamer of 6,400 tons deadweight. Messrs. Rodger have also received an order for a steamer of 8,500 tons deadweight from the Dollar Steamship Co., of San Francisco. Messrs. Rodger & Co. finding the entrance to the Port Glasgow Harbour basin, into which their vessels are launched, somewhat inadequate in width for the vessels they are now called upon to build, have prevailed upon the Harbour Trust to agree to the entrance being widened. This work will be proceeded with at once, and the cost will be defrayed by Messrs. Rodger & Co.

Messrs. Russell & Co., Port Glasgow, have secured a contract to build for the New Zealand Steamship Co. a twin-screw steamer 500 ft. in length which will be the largest ever built in Port Glasgow. She will be specially designed and equipped for carrying frozen meat and general cargo between this country and New Zealand, and will be fitted with machinery by Messrs. David Rowan & Co., Glasgow, Messrs. Russell not being themselves engineers.

Messrs. The Greenock & Grangemouth Dockyard Co., Grangemouth, have contracted through Messrs. Edward Lawrence & Co., Liverpool, to build two coasting passenger steamers for the Bombay Steam Navigation Co., for next season's work. The vessels, which will be built to Board of Trade requirements, will be handsome, substantial boats of good speed, with awning decks, and all the house and cabin work will be of teak. Machinery will be supplied by Messrs. Dunsmuir & Jackson, Govan Engine Works, Glasgow.

Messrs. John Hastie & Co., Kilblain Engine Works, Greenock, continue to install in merchant ships, built on the Clyde and other centres, steering gears of their well-known manufacture. On one day last month no fewer than three vessels which were running their trials at the same time had steering gear of Messrs. Hastie & Co.'s make. The vessels were the *Princess Adelaide* of the C.P.R.Co., the *Chindwin* of Messrs. Patrick Henderson & Co.'s line, and the *Chilka* of the British India Steam Navigation Co. Messrs. Hastie & Co. are at present engaged upon the gear for the new Orient Line steamer now under construction in the Clydebank works of Messrs. John Brown & Co., Ltd. In this connection it is of interest to state that Messrs. Hastie & Co. are constructing for the same steamship an auxiliary steering gear of a type entirely new to steamships of the mercantile or the naval marine. This is the Hele-Shaw-Martineau patent steering gear, the first set of which put to practical service is that installed in April this year on the steam yacht *Albion*, and which has given entire satisfaction. The gear being prepared for the Orient liner will, it is understood, be used at first mostly as a substitute for the regular gear on board where navigation is not difficult, and on straight open-ocean runs. By its employment in this way the patentees and makers, it is believed, guarantee a very substantial reduction in the amount of coal consumed on the voyage to and from the Antipodes.

Messrs. John Cran & Co., engineers and shipbuilders, Leith, who some time ago turned out two notable little vessels in the shape of Trinity House pilot ketches for use in the South, have recently received an order for a motor launch for the Thames Seamen's Mission. Like the two Trinity pilot craft, the vessel will be propelled by paraffin engines of the Beardmore type. She is to be 57 ft. long, 11 ft. 6 in. beam, and will be constructed throughout of steel to Lloyd's A river class. As she will rely solely on her propelling machinery for her means of progress, her engines will consist of a 75 h.p. four-cylinder Beardmore set consuming paraffin. Amongst other orders being executed in the Beardmore paraffin engines are four sets, of 9 h.p. each, to be installed in two Mexican tug vessels to be propelled by twin screws.

TYNESIDE AND WEARSIDE.

(From our Own Correspondent.)

Tyneside.

WITH the incubus of the shipbuilders' lock-out upon the whole industry, the volume of noteworthy events during the past month has enormously diminished. It is fortunate that at the moment of writing the result of the ballot is anticipated to be satisfactory to the resumption of normal work.

Sir Andrew Noble.—If, however, there is not much work going on at present, we can find satisfaction in contemplating the work of the past, and on the 23rd of September the people of Newcastle honoured Sir Andrew Noble and themselves by bestowing upon him, the freedom of the city in commemoration of fifty years' association with the Elswick firm. Sir William H. Stephenson made the presentation, and both at the ceremony and the subsequent dinner many words of appreciation of Sir Andrew Noble's distinguished services were spoken. On the same day the King of Italy conferred on Sir Andrew the Grand Cross of the Crown of Italy.

Messrs. Armstrong, Whitworth & Co.—Active operations are now taking place in the clearing of the ground at Walker for the below-bridges site, and excavation has also begun. The existing level of the ground is to be reduced some 70 or

50 feet, sloping down to three or four feet above high-water level. About 4,000,000 tons have to be moved by the contractors, Messrs. Edmund Nuttall & Co., of Manchester. Some correspondence has taken place between the firm and the River Tyne Commissioners, who are the lessors, concerning a restrictive clause regarding the height of buildings, but in every probability this clause will be waived.

Palmers' Shipbuilding & Iron Co., Ltd. The annual general meeting of shareholders held during the past month revealed causes for optimism in spite of the present stagnation. The turnover is greater, the management is efficient and the corner seems to be turned. The turbines for the *Hercules* are now in course of construction, and good progress is being made in the ship itself, so that it is probable that it will be delivered to the Admiralty within the contract time if the deadlock is settled. The steel works are also doing well.

Messrs. R. Stephenson & Co.—There are persistent rumours that the Hebburn shipyard of this Company will shortly be acquired, if the transfer is not already effected, by the Palmer Company. The reason assigned for this movement is that the mercantile work of the Jarrow firm is to be transferred to Hebburn, the Palmer yards being brought up-to-date to deal with Admiralty work. The dry dock attached to the Hebburn yard will naturally be a very valuable asset in such a scheme.

Messrs. Swan, Hunter & Wigham Richardson, Ltd.—Although the operations of this firm have been very much interfered with during the past month, there is plenty of work in the yard to be done when the men come back to do it. Previous to the lock-out the progress that was being made on the *Laconia* was phenomenal, the building of this 18,000-ton Cunarder being pushed forward at record speed.

Messrs. Hawthorn, Leslie & Co.—If this firm is feeling the results of inaction at present, its future seems very good. It has booked another Admiralty order, this time for the turbine machinery for one of the battleships now under construction at Devonport. The engines are to be of the Parsons type, capable of developing 31,000 H.P. at the propeller shaft in order to develop a speed of 21 knots on the boat. They are also busy with a similar set for the *Monarch*, now being built at Elswick. Work is also being finished on a Booth liner of 6,100 tons carrying capacity which was recently launched. The North-Eastern Marine Engineering Co., Ltd., of Wallsend, have the order for the engines in hand.

Messrs. Parsons' Marine Steam Turbine Co.—This firm has received a duplicate order from the Admiralty to that mentioned above, for the battleship now under construction at Portsmouth.

Sir William Stephenson.—In view of the great services Sir William Stephenson has rendered to the commercial community, the Newcastle Exchange has decided to place an oil-painting or bust on the Exchange.

Mr. Malcolm Dillon.—This gentleman, who has been so intimately associated with Messrs. Palmer's works at Jarrow, has been appointed to superintend the shipping and commercial interests of the Marquis of Londonderry.

Blyth.—A fire occurred at the Blyth shipyard during the past month, but was fortunately extinguished fairly early. The Blyth Harbour Commissioners have fixed an acetylene safety buoy at the entrance to the harbour.

Launches.—The stagnation may be judged by a report in the *North Mail* that during September only six vessels have been launched on the Tyne, compared with twelve last September. The total this year is sixty-seven compared with eighty-one in a similar period last year.

Wearside.

The distress on Wearside due to the lock-out is considerable, many allied trades being affected, and society pay being in some instances not forthcoming. The shipbuilding and similar operations going on are insignificant.

River Wear Commissioners.—The chief interest pertaining to the affairs of this body during the past month has been the election of representatives of the various interests, including the coal-owners and ship-owners.

Messrs. William Doxford & Sons, Ltd.—This firm has received an order from the Clan line of Glasgow for a vessel to be engaged in the Glasgow, Liverpool and Eastern trade.

THE TEES AND HARTLEPOOLS.

(From our Own Correspondent.)

Whitby.

The International Steamship Line, Messrs. C. Marwood and Co., managers, have sold the s.s. *Cambria* for about £8,000.

Middlesbrough.

Messrs. Sir Raylton Dixon & Co., Cleveland Dockyard, are reported to have secured an order for a steamer for Liverpool owners. The yard is practically at a standstill on account of the strike.

They have secured the contract to repair the s.s. *Bull* which has had her stem badly damaged when in collision with the s.s. *Topaz* in the Tees last month. The contract price is about £5,600.

Messrs. W. Harkess & Son report nothing new during the month; they are fairly busy taking all things into consideration. Prices remain very low.

Messrs. Richardsons, Westgarth & Co. keep fairly busy. They are reported to have secured the contract to supply the engines and boilers for a fruit boat to be built by the Goole Shipbuilding & Repairing Co., Ltd. They have also secured the contract to supply the engines and boilers for a steamer to be built locally for the Ellerman Line, Liverpool. They have a fair amount of work in their speciality department.

Messrs. Smith's Dry Dock Co. are to repair the s.s. *Topaz*, of Glasgow, and are busy with other work on hand.

Stockton and Thornaby.

The strike has affected the entire district, but enquiries are in the market for two or three steamers, and altogether there is a brighter outlook.

Messrs. R. Ropner & Son have recently launched the s.s. *Artemis* for Messrs. Chris. Michelsen.

Messrs. Richardson, Duck & Co. are reported to have secured the contract to build two cargo steamers, and will be busy when the strike is settled.

Messrs. Blair & Co. are reported to have ordered contracts for three sets of engines and boilers for steamers to be built locally, and are busy with present contracts.

West Hartlepool.

Messrs. W. Gray & Co. are reported to have secured no less than five orders for cargo steamers during the month, which, with the work in hand, will carry them into 1912. They also keep busy in the repair department.

Messrs. Irvine's Shipbuilding & Dry Dock Co., Harbour Yard, are reported to have secured the contract to build a steamer for Messrs. Lund & Marwood, of Whitby and West Hartlepool. They have on hand a steamer for Messrs. J. A. A. Van Mees, Rotterdam, but have nearly stopped owing to the strike; they however keep busy in the repair department, and have a number of enquiries on hand, one of which is for a twin-screw steamer for Liverpool owners.

The Central Marine Engine Works are busy with work on hand, and are reported to have secured the contract to supply the engines and boilers for the five steamers to be built by Messrs. W. Gray & Co.

Hartlepool.

Messrs. Irvine's Shipbuilding & Dry Dock Co., Middleton Yard, are reported to have secured a contract to build a cargo steamer for the Seaton Shipping Co., Messrs. Allison and Co. managers, similar to the s.s. *Ada*. They have also the s.s. *Bull* in dry dock having salvaged her after she was in collision with the s.s. *Topaz* in the Tees.

Messrs. Richardsons, Westgarth & Co. are reported to have secured both contracts for the engines and boilers for the cargo steamers to be built by Messrs. Irvine's Shipbuilding Co. They are also busy, especially in their speciality department.

The s.s. *Parisiana*, belonging to Messrs. Furness, Withy and Co., has been sold to the Empire Transport Co., London. The s.s. *Ingram*, built by the late firm of E. Withy & Co., is reported sold to foreigners. The s.s. *Lobelia*, belonging to the Lilly Steamship Co., is reported as sold, and is being replaced by a boat to be built by Messrs. W. Gray & Co.

THE HUMBER AND DISTRICT.

(*From our Own Correspondent.*)

Messrs. Earle's Shipbuilding & Engineering Co., Ltd.—have nothing much to report, owing to the lock out. Business is quiet in the shipbuilding department, but the engine works are fairly employed with both new work and outside repairs. The new steamer *Blackburn* will be handed over to her owners, the Great Central Railway, directly after her trials.

Messrs. Cooper & Co., Neptune Engine Works, are fairly busy with repairs. They have two steamers in dry docks, going under extensive repairs which will amount to a large sum. Their two dry docks are well booked up for coasting steamers undergoing repairs, and the branch shop at the Alexandra dock is also well employed in repair work.

The North-East Coast Engineering Works are steadily gaining ground and have been fairly busy during last month on the following steamers :—s.s. *Scandinavian*, s.s. *Bernicia*, s.s. *Bellucia*, s.s. *South Wales*, s.s. *Garfield*, s.s. *Moorfields*, s.s. *Riverton*, retubing main boilers and deck and engine-room repairs. The s.s. *Ben Vrackie* has been fitted with new H.P. cylinder cover, and engine-room and deck repairs done.

Messrs. Amos & Smith, Albert Dock Works, have booked several sets of machinery for Grimsby owners, but they have had to refuse several large ships for extensive repairs in dry-dock work, owing to the strike. They are also supplying two sets of engines for ships being built in Russia. The branch shop at Alexandra Dock has been fairly well employed with engine repairs.

Messrs. Woodall & Co., engineers and boilermakers, have had a fair month with engine and deck repairs, and their patent Handibloc is in great demand for at home and abroad, some very good orders having been booked.

Messrs. C. D. Holmes & Co., engineers and boilermakers, are booking fresh orders for machinery for Grimsby and Hull owners, and several orders have come in for centrifugal pumps and compound winches. Their main works in Alfred Street, and at the boiler-shop, are fully employed with repair work. The branch shop, situated at Alexandra Dock, has had a fair month in dry-dock work, also with propeller and engine work repairs.

Thomas Tate, engineer and boilermaker, Dryport, has had in hand the engine-room and deck repairs of the s.s. *Normandy*, s.s. *King*, s.s. *Edith*, and several local tugs. The schooner *Adolph Gajnai* has been in for deck repairs.

Messrs. Cochran & Sons, shipbuilders, Selby, have been very successful in booking several orders for Grimsby and local owners.

Messrs. Cook, Welton & Gemmell, shipbuilders, Beverley, have booked several orders for new trawlers, but on account of the lock-out things are quiet at the yard. A trawler was recently launched for a Grimsby owner.

The Hull Central Dry Dock & Engineering Co., Ltd.—Besides their own dry dock being employed, with the s.s. *Irvine*, a L. & Y. Ry. steamer and the s.s. *Lissette* going under extensive repairs, the Company has also had the s.s. *Aislaby* and s.s. *Persia* in the Hull and Barnsley dry dock (Alexandra Dock) under engine-room and deck repairs. The Company's dry dock is well booked ahead, and the fitting shop is well employed.

INDIA RUBBER GOODS.—The crude material from which the finished products of the manufactory are made is rubber as a base—Para for the finer class of goods which enter into the economy of the engine-room, as valves, jointing material and other articles which require to be of the highest quality ; and other kinds for the manufacture of general goods for which this style of rubber suits equally well and in some respects suits better. The raw rubber is treated in the following way. In the first process it is subjected to the crushing by means of rollers and the cleansing by hot and cold water until all the impurities are eliminated, by which time the lump is transformed into a thin sheet. The sheet is removed to the drying-room, where it is kept for a time at a constant temperature. The sheet is now greatly enhanced in value, due to the work expended upon it, and the drying-room presents an appearance of great interest, besides suggesting a calculation as to the value of the hanging sheets, the colours revealing the locality which gave birth to the producing tree. After being subjected to the atmosphere of the drying-room for the requisite time, the sheets are folded and stored on racks ready for service.

SOUTH OF ENGLAND AND ISLE OF WIGHT.

(*From our Own Correspondent.*)

Messrs. Day, Summers & Co., Ltd., Northam Iron Works, Southampton, have been notified that the steamer *Don Carlos*, recently built for Liebig's Extract of Meat Co., has made an excellent voyage to South America, where she will be engaged in the coasting trade. This vessel has a hold capacity of 300 tons and accommodation for twelve passengers on deck, including dining-saloon, bath-room and state-cabins, all of which are finished in white enamel. The vessel is lighted by electricity, and electric fans are fitted in the cabins, etc. The propelling machinery consists of a set of triple-expansion engines, having cylinders 14 in. by 22 in. by 37 in. diameter, and 27 in. stroke. The contract speed of 11 knots was easily secured. Yachts and pleasure steamers are taking up their winter quarters, and the following work is in progress. P.s. *Balmoral* has been on the slip, and is now on the mud completing her survey. Early this month the p.s. *Lorna Doone* will go on the slip for general overhaul, etc. The following yachts were undergoing survey last month :—*Alberta* 1,300 tons ; *Medusa*, 630 tons ; *Catania*, 670 tons ; and *Puscarora*, 650 tons. The latter yacht has been sold to Spanish owners, and as soon as survey is completed will fit out. Extensive repairs have been carried out on board Messrs. Topham, Jones & Railton's dredger *Devon*, and their hopper *Maxwelton* is undergoing repairs. The new 100-tons sheer legs for Aberdeen have successfully passed their tests. These legs were erected complete in less than five months from date of order. A start has been made on the Instructional Turrets to the order of the Admiralty for Chatham, Devonport and Eastney.

Atlantic Winter Sailings from Southampton.—Commencing in December the Atlantic sailing list will be curtailed, and the service will not be in full swing again until April. The *Teutonic* and *Majestic* will lie up, but the *Oceanic* and *Adriatic* will remain on the active list. The *St. Paul* and *Philadelphia* will take the Wednesday sailings, whilst the steamers of the Atlantic Transport Line will take the Saturday sailings, beginning with the *Minnetonka* on December 10th. There will be one vacant Saturday sailing date in each month.

The *Minnehaha*, which has been in the hands of Messrs. Harland & Wolff for several months undergoing extensive repairs and refitting, left the Trafalgar Dry Dock last month, and, after coaling, proceeded to sea. The dock will now be given over to the contractors, Messrs. Topham, Jones and Railton, who are to lengthen and widen it so as to easily accommodate the *Olympic* and *Titanic*. This work will occupy several months.

New Services.—In addition to the new services announced in our September issue, another is about to be inaugurated in connection with the chilled meat trade from South America. This service is to be maintained by the vessels of the Houlder Line, who intend running a fortnightly service from the Plate to Southampton. Previously these boats have proceeded direct to London, but according to the new arrangement Southampton will be the first port of call and London the terminal port. The Meat Companies at the back of this new undertaking are the Frigorico Argentino and the Compania Sansinena de Carnes Congeladas, who have decided to make regular shipments by the Houlder Line steamers. The cold storage accommodation at Southampton is on a very large scale, in fact the store is one of the largest in the Kingdom, having hanging facilities for about 15-20,000 quarters of chilled beef. The first consignment is expected early this month, and the Companies will then enter into serious competition with the American and American-Argentine Companies at present serving the South Coast.

Messrs. J. I. Thornycroft & Co., Ltd., Woolston Works, Southampton.—H.M. Ships *Larne*, *Lyra*, *Martin* and *Minstrel* :—The *Larne* had a satisfactory trial under weigh about the beginning of October, and the official trials will be completed early this month. The *Lyra* was launched on the 4th October, and rapid progress is being made with the remaining two vessels. H.M. Ships *Acheron* and *Ariel* :—A start was made last month with the riveting of the frames on the *Acheron* and the keel-laying of the *Ariel* was also completed last month. Firefloat *Gamma* :—The motors are being fitted on the above vessel. Paddle-steamer *Arabia* :—

The shell plating of this vessel is completed, and the paddle-boxes and sponson houses are erected. Motor-tank barge *Rocklight of London* :—The shell and deck plating of this vessel are now completed. Launches :—The first of the 63-ft. motor-boats was launched last month, and will shortly run her trials. Work is progressing rapidly on the 60-ft. twin-screw steam launch. New orders :—Orders have been received for a 36-ft. steam launch for police service in Ceylon, also for a 70-ft. barge for dockyard service. Repair work :—The Repairs Department have been well occupied during the past month with work on various troopships, yachts and commercial vessels.

THAMES.

(*From our Own Correspondent*).

Thames Ironworks Co.—This firm have, we understand, been invited to submit a tender for another battleship of the "Dreadnought type," part of the programme for 1910-11. The *Thunderer*, which is now being constructed at the works, will, it is hoped, be ready for launching in December. Tenders have already been sent in for two armoured cruisers and for two torpedo boats in the forthcoming programme, the contracts for the former of which are expected to be placed almost immediately. With the progress being made with the present vessel there is some reason to hope success will attend the efforts being made to secure further naval work here.

Shipping Co.'s Affairs.—Probably the largest cheque ever drawn for steamship purchase is that made out by the Royal Mail Steamship Co. for the purchase of the shares of the Pacific Steam Navigation Co. It was for a sum of £1,347,825, and is the ending of the negotiations entered into a few months ago and which met with the approval of the proprietors of both companies. The increase in size of the mail boats leaving the port of London of recent years is well known, and a further advance is imminent as the two boats now on the stocks for the P. & O. Co., the *Maloja* and the *Medina*, are to be 12,500 tons, which is seen to be an increase of 1500 tons over the *Morea*, the largest of the vessels at present running in the Company's service. The two new boats will follow in general the lines of the existing vessels, but will have certain novel features. The smoking-room is raised a deck higher to the promenade deck, and a verandah café added, a new feature in P. & O. boats. More room will be given for promenading by the hurricane deck being carried forward, giving additional cabin accommodation. Two boats are being built by the Company for their service to Australia *via* the Cape, the *Ballarat* and *Bendigo*, which will each be of 11,000 tons. These vessels will carry third-class passengers only and will be ready for service at the end of next year. Messrs. Geo. Thompson and Co. have had a new steamer, the *Themistocles*, launched from Messrs. Harland & Wolff's. This vessel is 516 ft. long by 62 ft. beam, and is intended for the firm's Australian passenger and cargo service, one whole deck being devoted to single-berth cabins. Messrs. J. T. Rennie & Co. intend, in their new steamer the *Intaba*, to carry a number of midshipmen, for whom special accommodation will be provided, and the training will be for four years, a premium of 100 guineas being paid. The idea, no doubt, is that the youths shall equip themselves under the Company's auspices for employment in their fleet of steamers. The *Intaba* is due to begin her maiden voyage before this year is out.

The New Thames Bridge.—An amended scheme has been placed before the City Corporation for the new St. Paul's Bridge and the reconstruction of Southwark Bridge, the former of which will cost about £1,646,983 and the latter £261,000, but as the County Council has limited its contribution to the former to £300,000, the construction on the north side of the river is likely to be somewhat curtailed. One of the proposals at present under consideration in connection with the scheme is the provision of a swimming bath on the river, presumably under or near the new structure. Southwark Bridge will be widened to 80 ft., while St. Paul's Bridge will be 80 ft. wide, increasing to 105 ft. at the northern approach, which is to end at Cannon Street. The City Corporation is now understood to undertake the whole cost out of the Bridge House Estate Fund, having apparently refused to accept the County Council's offer of £300,000, considering it inadequate for the scheme as originally outlined and which included a direct north and south tramway service over the new bridge.

The Warship at Blackfriars.—The sloop *Buzzard*, which has been for so many years a feature of the river off the Thames Embankment, is to be removed and replaced by a frigate, the *President*, which being a larger vessel will enable more guns to be mounted and more men of the Royal Naval Volunteer Reserve to be accommodated.

MERSEY AND MANCHESTER SHIP CANAL.

(*From our Own Correspondent.*)

WITH prospects of an early settlement of the labour troubles, together with the placing of new Admiralty and merchant work, and the new docks contemplated by the Dock Board, an era of prosperity seems to await the Mersey port and district. It is only fitting that a fair proportion of the world's shipping should have its origin in this truly great shipping centre.

Messrs. Cammell, Laird & Co.—For some weeks past the effect of the lock-out has been felt to some extent, and along with the other shipbuilding firms in the Federation work has been somewhat retarded. The *Racoon* left Birkenhead for Portsmouth on October 15th. The large floating dock is now beginning to show its proportions, and construction is being rapidly pushed forward. The machinery for the *Blonde* is now mostly on board at Pembroke, and it is expected that this vessel will be ready for steam trials early in December. The new destroyers, *Lapwing* and *Lizard*, are being rapidly advanced, and the two tenders for the submarine depot ship recently ordered from Messrs. Cammell, Laird & Co. are also well in hand, and will help to give employment to a number of hands. Another important Admiralty order has also recently been secured in the shape of a cruiser of the improved "Bristol" type. The three fast destroyers for the Argentine Government are making good progress, and it is hoped that this firm may secure its share of the new work now in the market for various South American States. The *Sarnia* is nearing completion, and will shortly join her sister ship the *Cæsarea* on the London and South-Western Co.'s service from Southampton. The *Highland Brae* will shortly be ready for trial, while the other two boats also for the Nelson Line are nearing the launching stage. The *Snowdrop* commenced running on the service on October 10th and both boats are proving very satisfactory. Extensions and additions to the already extensive plant are always being made, and it is the evident intention of the directors to maintain the facilities for both new and repair work to meet the most exacting requirements. The Liverpool steam fishing trawler *Smew* has been in for new propeller and rudder. The Johnstone liner *Quernmore* has left after extensive repairs and has gone over to the Liverpool side. The Liverpool tug *West Cock* has also been in for overhaul and repainting.

Messrs. H. & C. Grayson.—This firm have quite a number of new contracts on hand, besides their usual variety of large repair work. The two tenders for the Canadian Pacific Railway Co. will shortly be ready for trial. These boats are constructed to Lloyd's highest class and are specially adapted for river and dock work at Liverpool, and have been named the *Musquash* and *Gophar*. The *Highland Brigade*, the *Duchess* and the *Rebecca* steamers have been in the various docks owned by this firm for general repairs. The Liverpool Salvage Association steamer *Ranger*, and the Liverpool steamer *Carlingford* have also had extensive repairs. The steamer *Latchford*, damaged recently in the Manchester Ship Canal, has also been repaired. The firm has also been busy in other directions.

Liverpool Patents Co.—The Trident Firebar, made by this Company, was fitted to no fewer than between fifty and sixty steamers during the month of September.

The Mersey Docks and Harbour Board.—Great interest has centred in the salving of the dredger *Walter Glynn*, recently wrecked off the North Wall at Seaforth. The work has been in the hands of Lieut. Hugh Williams and Lieut. Gracey, under the supervision of Commander Mace, the board's water bailiff. As the dredger weighs over 1500 tons, the uprighting of the vessel from her position lying

in a bed of sand at 117 degrees to port, was no small task. Taking advantage of the spring tides, very special gear was used to accomplish the lift. The parbuckling wires were supplied by Messrs. Bullivant & Co., as were also the blocks, each capable of a strain of over 100 tons. These wires were fastened to the port rail of the dredger and attached to shore winches resting on a foundation 14 ft. deep composed of piles embedded in concrete. The lifting operations were assisted by the Board's powerful new lifting camels and also by the Board's steamer *Salvor*. The winches and foundations were temporarily lifted by the strain. It is expected that the salvage will be completed successfully.

An inspection was recently made by the Board's officials of the progress of work with Crosby Channel revetment scheme. In order to prevent the obstruction of the channel by the encroachment of the Taylors Bank, many thousand tons of North Wales stone have been dumped along the face of the bank. The work already done appears to be most satisfactory.

Training Ship "Indefatigable."—The committee of this floating institution have recently put into use a new motor water launch, which has been built by Messrs. William Roberts, Sons & Co., of Cranebank, Chester. Her dimensions are—length, 38 ft; beam, 10 ft.; depth, 5 ft.; gross tonnage, 12·38. She is between 30 and 40 horse-power and has four galvanized steel tanks of a total capacity of 2,500 gallons.

NORTH-WEST OF ENGLAND.

(*From our Own Correspondent.*)

The Shipbuilding Trade.—The orders on hand by Barrow shipbuilders are considerable, and Messrs. Vickers, Sons and Maxim can look forward with confidence to two years' brisk work in this department. Their capacity of production is very large, and it would take a good many ships in course of construction at one time to fill their yard. This may readily be understood when it is known that no fewer than five "Dreadnoughts" could be laid down at one time on the permanent berths, which have been provided, together with several smaller ships. At present there is only one big ship on the stocks, the *Princess Royal*, a battleship cruiser of the "Lion" type, and she progressed very well until the lock-out of boilermakers, which put a check to the go-a-headness which had previously characterized the work of building the ship. Where possible apprentices have been employed on this vessel, but not much further progress will be made until the black squad return to work. When that will be is questionable, but in a general sense it is felt that both masters and men have a desire to come to some fair settlement. H.M.S. *Dartmouth*, one of the cruisers of the Town class for the British Navy, is making satisfactory growth, and before long she will be ready for launching. The submarine department is still very busy, and another of these vessels of the D class was launched in October. The Chinese cruiser is gradually assuming shape, and efforts are being made to push forward the construction of this vessel, as it is anticipated more business may be coming from the same quarter. The huge floating dock built by the Vickers Company has been delivered at Rio de Janeiro. Her voyage across, by means of two Dutch tugboats, was accomplished in about ten weeks, which is a remarkable performance, seeing that it was only possible to take the dock at a speed of about three knots per hour. A powerful tugboat built by the Vickers Company for the Brazilian Government has already reached Las Palmas, and possibly by this time may have reached her destination.

Engineering.—There is very great activity on the engineering side of Messrs. Vickers' works at Barrow, indeed the firm was never so busy as at present in this branch of their operations. They have not only in hand the propelling machinery of the *Lion* and the *Princess Royal*, battleship cruisers, but the engines of the Brazilian battleship *Rio de Janeiro* building at Newcastle, together with the engines for H.M.S. *Dartmouth*, several submarines, a torpedo-boat destroyer and other important work. They are very fully employed in the construction of gun mountings for British warships and for vessels for foreign governments.

A New Order.—Messrs. Vickers, Sons & Maxim have booked a new order for one of the "Yarmouth" type of cruisers. They have already built the *Liverpool* and are now building the *Yarmouth*. The new vessel will be practically the same as the *Dartmouth* with the exception of certain improvements in the engine-rooms, which are the result of experience in the vessels which have already gone through their trials. These orders sandwich in very nicely between the big ships that are built. They represent about 5,500 tons each, but they are built to go fast and are very well-appointed vessels.

Shipyard Fire.—On Saturday, the 1st of October, a very disastrous fire took place at the Vickers Works, resulting in the total destruction of the joiners' shop, the finishing department, the tracing office connected with the naval draughtsmen's department, an immense cooling tower attached to the electric power house, and other damage, which roughly totals at about £40,000. The origin of the fire is not known, but it is believed to have originated through the fusing of electric wires. It is fortunate that the four fire brigades which were at work in putting out the fire managed to save the Company's stores and general offices, which were within a few yards of the conflagration. The work of rebuilding these shops is being rapidly proceeded with, and it is expected they will be ready for occupancy in a couple of months. In the meantime the joiners and the "lady tracers" thrown out of a job temporarily have been accommodated in other departments of the works.

Future Prospects.—Future prospects are very good, and it is believed the local firm will be busier than ever when once the lock-out is at an end. It is impossible and injudicious to say what new work is in progress, but it is evident that important orders are in view, and that in the near future these will crystallize. In the meantime Barrow shipbuilders and engineers have large countments, and many of them are on the time limit. Of course, they will get some relief in the sense of the strike or lock-out clause.

The Naval Airship.—Very great interest is naturally centred in the airship building at Barrow by the Vickers Company for the Admiralty. She is nearing completion, and was expected to be on her first aerial flight in October, but circumstances have prevented this, and it is now certain that it will be towards the end of November before she will be ready to take her first spin. Her officers and crew have arrived at Barrow, together with the hydrogen, by means of which she will be able to rise. The greatest secrecy is being still observed, and H.M.S. *Hermione*, with her crew of bluejackets, is at Barrow patrolling the airship shed.

Iron and Steel.—The iron and steel trades are quiet, and the demand is not so brisk as it has been. The orders for shipbuilding material, which at one time were largely entrusted to the Barrow Steel Company, now go elsewhere, as the mill has been proved too small for the larger plates now in use, and until a modern plant is put down orders cannot be taken. It is remarkable, however, that makers of hæmatite iron in the district send their crude product to Glasgow, and it comes back to Barrow in the shape of plates and other materials, which is like carrying coal from Newcastle and bringing it back again.

Messrs. Leonard Chapman & Co., Ltd., Importers and Manufacturers, Munton Road, London, S.E., report:

Graphite, as imported, according to quality.

	£ s. d.	£ s. d.	
Ceylon L.L. c.i.f. London ..	16 5 0	to 38 10 0	per ton
,, O.L. ,, ..	11 9 6	to 38 9 6	,,
,, chips ,, ..	9 5 0	to 28 0 0	,,
,, dust ,, ..	9 10 0	to 25 0 0	,,

Purified, milled and ground.

Ceylon, 97% to 99%, f.o.b. London	50 0 0	to 63 0 0	per ton	
,, 90% to 91% ,,	40 0 0	to 42 0 0	,,	
,, 80% to 81% ,,	30 0 0	to 32 0 0	,,	
,, 70% to 71% ,,	27 0 0	to 28 0 0	,,	
American large flake, f.o.b. London	45 0 0	to 49 0 0	,,	
,, small ,,	35 0 0	to 45 0 0	,,	
Joint Compd. per cwt.	2 9 0	to 2 12 6		
Paint Paste ,, ...	2 2 0	to 2 5 0		
Paint per gall.	0 4 9	to 0 5 3		

Wholesale lists of tinned goods on application.

BELFAST.

(*From our Own Correspondent.*)

Work in Progress.—According to Lloyd's returns there were nineteen vessels, with an aggregate of 232,000 tons, under construction in Belfast at the close of the quarter ended 30th September, as against 176,530 tons in the corresponding quarter of last year. There has been a steady increase of work on hand, and Messrs. Harland & Wolff and Messrs. Workman, Clark & Co. are fully booked up for a considerable time to come. It will be nearly twelve months before the keels for some of the orders can be laid down.

Messrs. Harland & Wolff.—The event of the month was, of course, the launch of the White Star liner *Olympic*, which took place on the 20th of October. The latest addition to the White Star fleet is, as is well known, the largest vessel afloat, and the transferring of this huge bulk from the stocks to the water was carried out with complete success, not the slightest hitch occurring. The inside work is well advanced, a great deal of the wood work having been completed, and the vessel is intended to take up her sailings in July next. Full particulars of this triumph of shipbuilding appear elsewhere. It has been reported that the Royal Mail Steam Packet Company are about to place an order for no fewer than five large steamers for their ever-increasing South American trade, and that three of these are to be built at the Queen's Island, but up to time of writing the rumour has not been definitely confirmed. The Bibby liner *Gloucestershire* is all ready for sea, and will shortly leave the port. At the present time Messrs. Harland & Wolff have the Elder Dempster liner *Albertville* in dry dock for extensive bottom damage repairs.

Messrs. Workman, Clark & Co.—The fitting-out of the *Aeneas*, recently launched by this firm for Messrs. A. Holt & Co., has almost been completed, and a further addition to this Company's fleet will shortly be launched from the north yard. A twin-screw of considerable size, building in the south yard, is rapidly approaching the launching stage. Messrs. Workman, Clark & Co. have recently carried out engine repairs to another Holt steamer, the *Theseus*.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Lisbon.—On September 20th, Messrs. W. Harkess & Son, Ltd., of Middlesbrough, launched the s.s. *Lisbon* for Messrs. The Ellerman Lines, Ltd. Her dimensions are 231 ft. 6 in. by 35 ft. 6 in. by 18 ft. 6 in. She will carry 2,000 tons on light draught, and is fitted with 'tween decks throughout. Built to a good specification, she is specially designed for the owners' Liverpool and Lisbon wine trade. Her engines are by Messrs. Richardsons, Westgarth & Co., Ltd., of Middlesbrough, and are capable of driving her a speed of 10½ knots loaded. The launching ceremony was performed by Mrs. T. W. Ridley, of Coatham, Redcar.

Laristan.—On September 21st, Messrs. Short Brothers, Ltd., launched from their shipbuilding yard at Pallion, Sunderland, the s.s. *Laristan*, built to the order of Messrs. The Hindustan Steam Shipping Company, Ltd., of Newcastle-on-Tyne. The leading dimensions of the vessel are :—Length, 360 ft. 6 in. ; breadth, 60 ft. 10 in. ; and depth moulded, 25 ft. 8 in. She is built on the Isherwood principle, with single deck, poop, bridge and top-gallant forecastle, to take Lloyd's highest class, and is designed to carry a deadweight cargo of 6,200 tons on a moderate draught of water. Ample water ballast is provided throughout double bottom, and in fore and after-peak tanks, to enable the vessel to run in ballast with safety. Six watertight bulkheads are fitted across the ship, and steel centre line bulkhead between hatches with wood shifting boards for grain cargoes in way of hatches. Eight steam winches, steam windlass, steam-steering gear placed in engine-room, controlled from standards in wheelhouse and on flying bridge, and connected to quadrant on rudder by rods and chains, will be fitted, taking steam from a large donkey boiler fitted on main deck. Eight derricks are provided on masts, worked from strong derrick tables with cross trees above, and two derricks working from strong posts at cross bunker hatch. The propelling machinery will be installed by Messrs. John Dickinson and Sons, Ltd., Sunderland, consisting of engines with cylinders 24½ in., 40 in. and 66 in. diameter with a stroke of 45 in., driven from two large multitubular boilers of 180 lbs. pressure.

Harpalion.—On October 4th, Messrs. William Gray & Co., Ltd., launched the handsome steel screw steamer *Harpalion*, which they have built to the order of Messrs. J. & C. Harrison, Ltd., London. She will take the highest class in Lloyd's, and is of the following dimensions, *viz.* :—Length over all, 441 ft. ; breadth, 53 ft. 6 in. ; and depth, 31 ft. 8 in., with two decks laid, extra long bridge, poop and top-gallant forecastle. A large saloon panelled in teak and having square windows in front and a dome-shaped skylight, together with state-rooms, captain's, officers' and engineers' rooms, etc., are fitted up in houses on the bridge-deck amidships, all heated by steam and fitted with ventilating and sanitary appliances throughout. Accommodation for crew will be fitted up in the forecastle. The hull is built with deep frames and holds quite clear of all obstructions, cellular double bottom and large aft and fore-peak ballast tanks, ten steam winches, return exhaust pipes and winch condenser, steam-steering gear amidships, hand-screw gear aft, two masts with telescopic topmasts, derrick tables, out-riggers and eighteen derricks, also Porter's patent derrick sockets for dealing with heavy lifts, patent direct steam windlass, fresh water distiller, shifting boards, trunks and feeders for bulk grain cargoes, stockless anchors, steel lift boats, ice-house, ventilation for the Eastern trade, electric lighting and all requirements for a first-class cargo steamer. The machinery will be supplied by the Central Marine Engine Works of the builders, the engines, triple-expansion, have cylinders 28 in., 45 in. and 75 in. by 51 in. stroke ; the main condenser is designed to maintain a high vacuum, whilst attention has been given to ensure a high temperature in the boiler feed water. Steam is generated in four large boilers of the builders' "flanged shell" type, at a pressure of 180 lbs. per square inch, the heating surface being over 8,900 square feet, and is worked under Howden's system of forced draught. With the bronze propeller fitted the speed of the vessel will be about 11 knots. Messrs. Wailes, Dove and Co.'s "Bitumastic" enamel was applied to the bunkers and tanks under engines and boilers, and their "Bitumastic" covering to tank tops in engines and boiler-rooms and decks in bunkers.

Steel Ship Caisson.—On October 4th, a steel ship *Caisson* (constructed to the builders' own design) for H.M. Dockyard, Devonport, was launched from Messrs. Edward Finch & Company's yard at Chepstow. Her dimensions are :—Length, 81 ft. 8 in. ; breadth, 23 ft. ; depth, 35 ft. ; and weight, 400 tons. She was towed to her destination, and arrived there on Friday, the 7th October.

Storstad.—On October 4th, there was launched at Walker-on-Tyne the largest steamer yet built on the Isherwood system of longitudinal framing. The vessel has been constructed to the order of Messrs. A. F. Klaveness & Co., of Sandefjord, and is of the following principal dimensions :—Length over all, 452 ft. ; breadth extreme, 58 ft. She is of the shelter-deck type, and is capable of carrying a total deadweight of 10,650 tons on a moderate draught of water. She is intended for the iron ore trade between Wabana (Newfoundland) and Sydney (Cape Breton).

Syndic.—On October 12th, Messrs. The Blyth Shipbuilding and Dry Docks Co., Ltd., launched from their shipbuilding and graving dock works the fine steel screw steamer *Syndic*, built for Messrs. Isaac B. Pearson & Co., of Glasgow. This vessel, which measures 326 ft. in length, with a beam of 45 ft. 10 in., has been constructed under Lloyd's Special Survey for their highest class. She is of the single-deck type, having poop, bridge and top-gallant forecastle. The accommodation for the Captain is in a steel deck-house, and for the officers and engineers in sidehouses on the bridge, whilst crew will be berthed in top-gallant forecastle. The *Syndic* is specially adapted for the general cargo and wood trade, having large hatches and clear holds, together with the best and latest design of deck machinery, including five cargo winches for the quick and economical working of the cargo. Triple-expansion engines of good power will be supplied by Messrs. The North-Eastern Marine Engineering Co., Ltd., of Wallsend.

A Cochran (Annan) donkey boiler with patent seamless furnace has been supplied and fitted.

Francisco.—On October 12th, the fine steel screw steamer *Francisco* was launched from the yard of Messrs. The Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne, for the fleet of Messrs. Thos. Wilson, Sons & Co., of Hull. The vessel has been specially designed for this trade, and built to the highest class in British Corporation. She is built on the deep frame and girder system, rigged as a two-masted schooner, and is fitted with all the latest improvements and up-to-date appliances to make her in every way a first-class liner. She is about 425 feet in length, with three complete steel decks, including the shelter deck all fore and aft, with a cargo carrying capacity of about 9,000 tons. A large quantity of water-ballast is carried in the cellular double bottom and after-peak tank, which, with the bunkers, will put the vessel in excellent trim irrespective of cargo. The shelter 'tween deck is of exceptional height, and is arranged so that a large number of emigrants can be carried. The saloon accommodation is placed on top of shelter deck, and the accommodation for captain, officers and engineers is also in steel houses on the same deck. They are all tastefully fitted out and commodious. Loading and discharging facilities are considerably in excess of usual. The steamer has twelve derricks and ten powerful steam winches with extended shafts by Messrs. John Lynn & Co., Ltd., Sunderland, to ensure the most expeditious handling of cargo. Powerful combined steam and hand-steering gear on the Wilson-Pirrie principle by Messrs. Donkin & Co., Newcastle, will be fitted in steel house on shelter deck aft, and actuated from amidships by telemotor gearing, and a powerful steam windlass of the latest type by Messrs. Emerson, Walker and Thompson Bros. The vessel has been built to a fine model and to include the most modern improvements, including Board of Trade Regulations. Triple-expansion machinery of special design and construction will be supplied by Messrs. Earle's Shipbuilding & Engineering Co., Ltd., Hull, with extra large pressure boilers, the indicated horse-power being about 3,000, the working pressure 180 lbs., and the boilers fitted with Howden's forced draught.

Escrick.—On October 20th, Messrs. William Gray & Co., Ltd., launched the handsome steel screw steamer *Escrick* which they have built for Messrs. The London & Northern Steamship Co., Ltd. (Messrs. Pyman Brothers, London, managers). The vessel is of the shelter-deck type and will take the highest class in Lloyd's Register. Her dimensions are :—Length over all, 395 ft. ; breadth, 53 ft. 6 in. ; and depth, 25 ft. 5 in. The saloon, state-rooms, captain's, officers' and engineers' rooms, etc., are in houses on the bridge deck and the crew's accommodation forward. The hull is built with deep bulb-angle frames, dispensing with hold beams and leaving large clear holds, cellular double bottom and fore and aft-peak ballast tanks. Ten steam winches, derrick tables and outriggers and double derricks, steam-steering gear amidships, hand-screw gear aft, patent direct steam windlass, large horizontal multitubular donkey-boiler, fresh-water distiller, steel grain divisions, stockless anchors, telescopic masts, boats on deck overhead and all requirements for a first-class cargo steamer. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 25 in., 41 in. and 68 in. diameter with a piston stroke of 48 in., and two large steel boilers for a working pressure of 180 lbs. per square inch. The ship and machinery have been built under the superintendence of Mr. R. T. Rutherford on behalf of the owners, and the ceremony of christening the steamer *Escrick* was gracefully performed by Miss Joyce Pyman, daughter of F. H. Pyman, Esq., J.P., London.

LAUNCHES Scotch.

Estrella.—On September 22nd, Messrs. Ramage & Ferguson, Ltd., launched a finely-modelled steel screw steamer named *Estrella* for the London and Portuguese trade of the Ellerman Lines, Ltd., Liverpool. The principal dimensions of the vessel are :—Length, 230 ft. ; breadth, 34 ft. 8 in. ; depth, 18 ft. 7 in. The construction of the vessel is in advance of the most modern practice, having been built on the longitudinal girdered pillared system, without side stringers or hold beams. A cellular double bottom is provided throughout the full length of the vessel. An electric light installation is fitted complete. The deck machinery and general arrangements are specially adapted for expeditious handling of special cargoes. The vessel has been constructed to the highest class in the British Corporation, with scantlings in excess of their requirements, usual in vessels built for the Ellerman Lines. Triple-expansion engines are fitted with cylinders 16½ in., 28¾ in. and 48 in. diameter by 33 in. stroke, and steam at 205 lbs. pressure will be supplied by two large boilers fitted with Howden's forced draught. A Cochran (Annan) donkey boiler has been supplied and fitted.

Drumcraig.—On October 1st, there was launched at Port Glasgow the screw steamer *Drumcraig*, of 5,000 tons gross, built to the order of Messrs. Joseph Chadwick & Son, Liverpool. She is 410 feet in length, 52 feet 3 inches in breadth, and 28 feet 3 inches in moulded depth. The machinery consists of engines with cylinders 27 in., 44 in. and 73 in. diameter respectively, and a stroke of 48 inches.

Howick Hall.—On October 1st, at Port Glasgow, there was launched a screw steamer, built for the New York and South American service managed by Messrs. C. G. Dunn & Co., Liverpool. The principal dimensions of the vessel are :—Length, 413 feet ; breadth, 51 feet 6 inches ; depth, 29 feet 7 inches to upper deck. She is rigged as a fore and aft schooner, and has a raised poop, in which the crew are accommodated, and long bridge and raised top-gallant forecastle combined. She is fitted with appliances for the rapid handling of very heavy cargoes, including lifting gear for weights up to 35 tons. The steamer will have triple-expansion engines having cylinders of 27½ in., 45 in. and 75 in. diameter respectively, and a stroke of 51 inches ; four single-ended boilers, 14 feet 6 inches diameter by 11 feet 6 inches in length, and designed for a working pressure of 180 lbs. The vessel is classed with Lloyd's Register for their highest class longitudinal framing.

Valparaiso.—On October 17th, there was launched at Port Glasgow a 400-ton steamer, named *Valparaiso*, which has been built for service in South America. The machinery will be supplied from Glasgow.

Baron Renfrew.—On October 17th, there was launched at Port-Glasgow the steamer *Baron Renfrew*, which has been built to the order of Messrs. Hugh Hogarth & Sons, Glasgow. The dimensions of the vessel, which has a complete shelter-deck, are :—Length, 275 feet ; breadth, 40 feet ; depth (moulded), 29 feet, with a deadweight carrying capacity of 3,100 tons. After the launch the steamer was towed to Glasgow, where she will be engined. Messrs. Wailes, Dove and Co.'s " Bitumastic " Covering was applied to tank top in engine and boiler rooms, and their " Bitumastic " enamel to boiler-room tank and bunkers. A Cochran (Annan) donkey boiler with patent seamless furnace has been supplied and fitted.

Peewit.—On October 18th, Messrs. Wm. Simons & Co., Ltd., Renfrew, launched from their works with steam up and ready for work a twin-screw hopper barge, which they have constructed to the order of the Bombay Port Trustees. The vessel has been built under the direction of the Port Trust Consulting Engineers, Messrs. Sir J. Wolfe Barry and Partners, Mr. George Turner being Resident Inspector. This hopper steamer, which was gracefully named the *Peewit* by Mrs. Turner, of " The Leas," Folkestone, as it left the ways, has a hopper capacity of 600 tons, and will be employed in connection with the port improvements now being carried on at Bombay. The vessel will be propelled at a speed of 10 knots per hour by two sets of compound surface-condensing engines supplied with steam from two steel boilers. All modern auxiliaries will be provided in the engine-room. The *Peewit* is the eighth dredging vessel that Messrs. Wm. Simons & Co., Ltd., have constructed for the Bombay Port Trust.

Elisabethville.—On October 20th, Messrs. Alex. Stephen and Sons, Ltd., Linthouse, launched a twin-screw passenger and cargo steamer, which they have built to the order of Messrs. Elder, Dempster & Co., Ltd., Liverpool. The dimensions of the vessel are :—Length, 430 ft. ; breadth, 55 ft. ; depth, 37 ft. ; and she has been constructed in accordance with the rules of the British Corporation. She has been designed to accommodate a large number of passengers, and to maintain a high speed on service with a considerable

deadweight on board. The machinery has also been constructed by the builders. Messrs. Wallis, Dove & Co.'s "Bitumastic" enamel was applied to boiler-room tank peaks, bilges and bunkers, and then "Bitumastic" covering to tank top in boiler-room.

LAUNCHES—Irish.

Star of India.—On September 22nd, Messrs. Workman, Clark & Co., Limited, Belfast, launched from their South Yard a handsomely modelled twin-screw steamer built by them for the well-known Star Line of steamers owned by Messrs. J. R. Corry & Co., Ltd., of London. The *Star of India* is a three-decked vessel 486 feet in length, with a gross tonnage of about 7,300, and has been built under Lloyd's special survey for the highest class in their Registry, besides complying with the Board of Trade requirements for a first-class cargo steamer. She is the tenth vessel built by this firm for the Star Line fleet, and has been specially designed for the conveyance of frozen meat and other products from the Australian and New Zealand Colonies. The cargo space is divided into five large holds, three of which have been insulated and otherwise prepared for carrying chilled and frozen meat. For the preservation of this cargo during transit a large plant of refrigerating machinery has been arranged. Each of the five holds is furnished with a large hatchway equipped with steam winches and derricks capable of dealing with heavy cargo. Comfortable accommodation for a number of passengers has been arranged in state-rooms in the midship deckhouse, with a spacious dining-saloon adjoining. The officers' quarters are also placed in this deckhouse with the captain's rooms on the deck above, while the engineers' and petty officers' rooms are in a deckhouse at the after end of the engine casing. The propelling machinery consists of two sets of triple-expansion engines, complete with all necessary auxiliaries, supplied with steam from four large steel boilers working under forced draught.

Themistocles.—On September 22nd, there was launched at Belfast the twin-screw 11,400-ton steamer *Themistocles*, which has been built by Messrs. Harland & Wolff for the Aberdeen Line (Messrs. George Thompson & Co.). The vessel, which is 516 ft. long over all, is classed 100 A1 at Lloyd's. She will be employed in the Company's service between London and Australian ports *via* the Cape of Good Hope, and will make the passage to Melbourne in about forty days. The *Themistocles* has a large cargo capacity. Her six hatches are served by seventeen winches, and powerful electric lights are provided. The vessel is insulated for the carriage of frozen cargo of all kinds upon the latest principles. Batteries of coils are provided for the carriage of fruit, and two compartments have been specially adapted for the conveyance of chilled beef. Two classes of passengers only will be carried, namely, first and third. This enables the whole of the midship accommodation to be devoted to the former, and the whole of the after accommodation to the latter. The state-rooms are placed on the bridge and awning decks. The bridge deck is devoted entirely to single-berth cabins, which can, however, be made intercommunicable if required, and the awning deck accommodation is composed of Bibby tandem cabins of large size. The quarters of the 3rd-class passengers are situated on the poop, main and 'tween decks, and comprise single, two, four, six and eight-berth cabins. The dining-saloon is a fine apartment, extending right across the ship and seating about 250 people. The smoking-room and general room, both very large apartments, are placed on the awning deck. The *Themistocles* will sail from London on Feb. 15th, while the *Demosthenes*, a sister ship now under construction in the same yard, will begin her maiden voyage on April 12th.

TRIAL TRIPS.

Inventor.—On September 8th, the large steel screw steamer *Inventor*, which has been built by Messrs. David & William Henderson & Co., Ltd., Glasgow, to the order of Messrs. Thomas & James Harrison, Liverpool, underwent her trials on the Firth of Clyde. This addition to the already large fleet of vessels owned by Messrs. Harrison is 470 ft. long between perpendiculars by 58 ft. broad by 34 ft. 10 in. depth moulded, has a gross tonnage of 7,680 tons, is classed in Lloyd's 100 A1, and fulfils the requirements of the Board of Trade for their passenger certificate. She is rigged as a four-masted schooner and has an exceptionally large number of powerful derricks which, with ten steam winches, provide ample means for the rapid loading and discharging of large cargoes. Comfortable accommodation is provided on bridge deck amidships for passengers, also for officers, engineers, etc., while the petty officers are berthed in forecastle, and the crew in poop. The machinery, which was constructed by the builders, consists of quadruple-expansion engines, having cylinders 25½ in., 36½ in., 52 in. and 74 in. dia. by 54 in. stroke, with steam from three boilers at 215 lbs. pressure. During the trials everything worked satisfactorily, and a mean speed of 14 knots was easily attained. The owners were represented by Thos. Hughes, Esq., Messrs. Richardsons and Balfour and Captain Turner.

Ingleside.—On September 8th, the s.s. *Ingleside*, built by the Tyne Iron Shipbuilding Co., Ltd., of Willington Quay-on-Tyne, to the order of Messrs. The Rowland & Marwood's Steamship Co., Ltd., of Whitby, was taken for her trial trip off the Tyne. The engines, which have been constructed by Messrs. John Dickinson & Sons, Ltd., Palmer's Hill Engine Works, Sunderland, have cylinders 24 in., 40 in. and 66 in. by 45 in. stroke, with two large single-ended boilers, 180 lbs. working pressure, and they were run on a series of different speeds so as to obtain progressive speed results, and the trials were in every respect a complete success. For Launch, see September issue.

Wedgwood.—On September 13th, the loaded trial trip took place of s.s. *Wedgwood*, built by Messrs. Robert Thompson and Sons, Ltd., of Southwick Yard, to the order of Messrs. Wm. France, Fenwick & Co., Ltd., of London and Sunderland. The vessel is of the raised quarter and well deck type, and built to take the highest class at Lloyd's. Her principal dimensions are:—Length overall, 274 ft. 3 in.; breadth, 38 ft.; depth moulded 18 ft. 2 in.; and she will carry about 2310 tons deadweight on a light draught of water. She is fitted with bulb-angle framing, the holds being left clear of all obstructions. There are four very large hatchways arranged to make her perfectly up-to-date as a self-trimmer and to facilitate rapid loading. Four powerful steam winches with latest improvements are supplied, with steam from a large vertical donkey boiler, and in addition to the usual derricks, four gaffs are fitted, the masts being strengthened for this purpose. To enable her to make quick return voyages, ample water ballast is provided throughout the cellular double bottom and in fore and after peaks, the former being divided longitudinally and athwartships for trimming purposes, and fitted with large tank suction pipes and extra large ballast donkey for quickly pumping out water ballast. The inside of holds, bunkers and engine and boiler-room tanks are coated with enamel. Accommodation for the captain and steward is provided in the poop, the saloon being tastefully fitted up in different shades of oak. A steel house is also arranged for the captain at fore end of bridge. Spacious rooms for the officers and engineers are arranged at the sides of the casing under the bridge deck, the petty officers and crew being berthed in the forecastle. The engines have been supplied by Messrs. The North-Eastern Marine Engineering Co., Ltd., Sunderland, with cylinders 21½ in., 36 in. and 59 in. by 39 in. stroke, steam being supplied by two extra large boilers working at 180 lbs. pressure. During construction the vessel and machinery have been under the personal supervision of Messrs. Thompson & Eyres, of Sunderland. The speed trials were run on the measured mile off Whitley and the guaranteed mean speed of 10½ knots was easily attained, the engines running with the utmost smoothness. Mr. J. E. Dawson, who represented the owners, expressed entire satisfaction with vessel and machinery. After the trial the vessel proceeded to London.

Forestay and Mainstay.—On September 13th, the steam-tugs *Forestay* and *Mainstay*, built at Paisley to the order of Messrs. Hull, Blyth & Co. for service at Port Said, carried out satisfactory trials. The vessels proceed immediately to Port Said.

Artemis.—On September 17th, the s.s. *Artemis*, built by Messrs. Ropner & Sons, Ltd., of Stockton-on-Tees, made her official trial trip in the Tees Bay. The vessel has been built under the superintendence of Captain Hansen, of Bergen, the commander of the vessel, and on trial she behaved in a

thoroughly satisfactory manner. After some very satisfactory trial runs, during which the vessel attained a speed of 11½ knots, she went round to the Tyne, where she will take bunkers and proceed to Norway to load.

Farn.—On September 23rd, this vessel, recently built by Messrs. Wm. Doxford & Sons, Ltd., to the order of the Fargrove Steam Navigation Co., Ltd. (Messrs. Farrar, Groves and Co.), London, ran her sea trial, when a speed of 11½ knots mean was obtained. For Launch see October issue.

Lorca.—On September 29th, the new screw steamer *Lorca* built by Messrs. John Readhead & Sons, Ltd., West Docks, South Shields, to the order of The English & American Shipping Co., Ltd., of which the managers are Messrs. C. T. Bowring & Co., Ltd., London, was taken to sea on her official trial trip. The vessel is of the improved single-deck type, with large holds clear of beams and other obstructions in stowing cargo, and is of the following dimensions :—Length over all, 376 ft. ; breadth, 51 ft. ; depth moulded, 27 ft. 8½ ins. She carries a large cargo on a light draught of water. There is a long bridge amidships extending beyond the engine and boiler space, and on which are situated the steel deck houses containing the cabins for captain, officers, engineers and apprentices, over which again are placed the steel chart and wheel houses, pilot bridge, etc. The arrangements for the loading and discharging of cargo are full and complete, there being eight powerful steam winches to work the ten derricks, which feed large hatchways into the holds. An iron centre line bulkhead is fitted for carrying grain cargoes, and a large quantity of water ballast is carried throughout the double bottom, and also in the after peak. The engines and boilers have also been constructed by Messrs. John Readhead & Sons, Ltd., the cylinders being 25½, 42 and 69 inches diameter by 48 inches stroke, with three boilers of 180 lbs. pressure. The vessel is built to Lloyd's highest class, and to their special survey. After the trial, which was in every way satisfactory to all concerned, the vessel proceeded to Dunston to load for Barcelona under the command of Capt. Orchard. This is the eighth vessel built for Messrs. C. T. Bowring & Co., Ltd. by the above firm.

Snowdrop.—On September 30th, the *Snowdrop*, the second of the two new passenger ferry-steamers built by Messrs. Cammell, Laird & Co., Ltd., at their Birkenhead yard, to the order of the Wallasey Urban District Council, went down the Mersey on her official trials, after being fitted with her machinery, which has been supplied by the shipbuilders. The trial trip proved in every way highly satisfactory, a mean speed of 12¼ knots being attained over the measured mile. The construction of the vessel and machinery has been carried out under the supervision of Messrs. Flannery, Baggallay & Johnson, Ltd., of London, Liverpool and Rotterdam, and the Ferries Manager, Capt. Howard E. Martin, and the Ferries Engineer, Mr. R. Rennie. For Launch see September issue.

Driebergen.—On October 1st, the new steel screw steamer *Driebergen* proceeded on her official trial trip in Hartlepool Bay after adjusting compasses. She has been built to the order of Messrs. Furness, Withy & Co., Ltd., West Hartlepool, for Mr. J. J. A. van Meel, of Rotterdam, by Messrs. Irvine's Shipbuilding & Dry Docks Co., Ltd., Harbour Dockyard, West Hartlepool, and her dimensions are 289 ft. 6 in. by 40 ft. 2 in. by 20 ft. 6½ in. The vessel has a single deck, poop, bridge and topgallant forecastle, and has been built to British Corporation Registry's highest class. A double bottom is fitted throughout on the cellular principle, and the after peak is arranged as a trimming tank. She is constructed with bulb-angle frames and longitudinal stringers, ensuring clear holds for the stowage of bulky cargoes. Four watertight bulkheads divide the vessel into five watertight compartments. There are four large hatches, with a powerful steam winch to each, and the bulwarks have been specially strengthened for the carriage of deck cargo, the vessel being replete with all the latest improvements for rapid loading and discharging. A powerful quick-warping steam windlass is fitted forward for working the cables, and steam-steering gear is fitted amidships, with hand-screw gear aft, and a large multitubular donkey boiler is also fitted. The cabins are heated with steam, and the sanitary, ventilating and lighting arrangements are effected on the most improved lines. The propelling machinery and boilers have been supplied and fitted by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool. The sizes of the cylinders are 20½ in., 33 in., 54 in. by 36 in. stroke, and steam is supplied by two large single-ended boilers working at 180 lbs. pressure per sq. in. The vessel's performance was very satisfactory, the engines working exceedingly well, a speed of 11 knots being attained on the measured mile at Whitley Bay. A Cochran (Annan) donkey boiler with patent seamless furnace has been supplied and fitted.

Renee Marthe.—On October 6th, Messrs. Osbourne, Graham and Co. sent to sea for her official trial trip the steel screw steamer *Renee Marthe*, which they have specially constructed to the order of Fernand Bouet, Esq., of Caen. After the trial, the vessel proceeded on her first voyage to St. Nazaire. For Launch see October issue.

Thisbe.—On October 7th, the new steamer *Thisbe*, built by Messrs. The Sunderland Shipbuilding Company, Limited, proceeded on her official loaded trial. The principal dimensions are :—223 ft. between perpendiculars ; 33 ft. breadth extreme ; and 16 ft. deep, having raised quarter-deck, bridge and top-gallant forecastle ; highest class in Bureau Veritas, under special survey, and carrying about 1,450 tons deadweight upon a light draught ; water ballast is fitted in cellular bottom and peak-tanks. The deck machinery consists of four steam winches, steam-steering gear and direct steam windlass. Accommodation is placed on top and partially underneath the bridge for captain, officers and engineers, and for sailors and firemen in forecastle. The saloon is amidships and is fitted in polished hardwoods. The main engines are by Messrs. The North-Eastern Marine Engineering Co., Ltd., Sunderland, and have cylinders 17½ in., 29 in. and 47 in. by 33 in. stroke, steam being supplied by a large boiler working at a pressure of 180 lbs. per square inch. After proceeding to sea, the vessel made several runs over the measured mile fully loaded, when a mean speed of 11 knots was obtained. After this a continuous speed trial was run, which gave entire satisfaction to all on board. The steamer has been built to the order of Messrs. G. Lamy and Co., of Caen, and during construction has been inspected by Messrs. Swan & Macfarlane, Newcastle, and also by Mons. Halbique, on behalf of the owners. After trial the vessel proceeded on her voyage to Caen. A Cochran (Annan) donkey boiler with patent seamless furnace has been supplied and fitted.

Marsden.—On October 10th, the new steel screw steamer *Marsden*, built by Messrs. Wood, Skinner & Co., Ltd., Bill Quay-on-Tyne, to the order of Messrs. The Burnett Steamship Co., Ltd., Newcastle, left the Tyne for her official trial trip. During the run off Whitley Bay, the machinery worked splendidly throughout and maintained a speed of 11½ knots. For Launch see October issue.

Walbrook.—The twin-screw tugboat *Walbrook*, built by Messrs. Ferguson Brothers, Port Glasgow, for the Port of London Authority, recently ran speed trials on the measured mile, and afterwards towing trials at Port Glasgow. Both tests were considerably in excess of the contract. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel was applied to all internal surfaces from gunwale to keel and between peak bulkheads.

THE PORHYDROMETER.—The adoption of the Porhydrometer is steadily becoming more general. We are informed that the company are at present occupied on quite a number of contracts. They are fitting out at present a vessel for the Hamburg-American Line, which will probably be completed about the end of this month, when, by kind permission of the Hamburg Co., a demonstration of the working of the instrument will be given in Hamburg. A large new cargo steamer at present building in Sunderland is also being fitted and another building in Norway. The Belfast Harbour Board have ordered three large barges employed in carrying the harbour dredgings to be fitted and intend controlling the quantities of material transported under their contracts by Porhydrometer weights,instead of the old cubic measurements. Commander G. E. Holland, C.I.E., D.S.O., marine superintendent of the London and North-Western Railway Co., writes as follows with regard to the installation on the steam coaling vessel *Herald* : "I am quite satisfied with the working of the Porhydrometer, and I have no hesitation in saying that I consider it an extremely useful and accurate instrument."

FOREIGN TRIAL TRIP.

Nora.—On October 5th, the steamship *Nora*, built by Messrs. The Antwerp Engineering Company for Mr. J. Lauritzen, Esbjerg, went on her trial. The vessel, which has been built for the wood, coal and general cargo trades, is of the following dimensions :—Length, 208 feet ; breadth, 30 feet 9 inches ; moulded depth, 15 feet 5 inches. She carries 1,250 tons on a 14-foot draught. The machinery has been built by Messrs. The North-Eastern Marine Engineering Company, Sunderland, and consists of triple-expansion surface-condensing engines, and two marine multitubular boilers of 180 lbs. pressure. The speed realized was 9½ knots, the engines working smoothly.

BOARD OF TRADE EXAMINATIONS.

1910. Extra First Class.
Aug. 18th—Hackney, William A. .. Ex 1C Belfast

NOTE—1C denotes First Class : 2C Second Class.

August 18th, 1910

Ankers, Alfred 2C Liverpool
Armstrong, H. 2C Liverpool
Bates, Sydney .. 2C Leith
Bennett, B..... 2C N.Shields
Bullen, Harold 1C Cardiff
Burton, S. H... 2C South'ton
Buttrum, F. E. 1C London
Chapman, J. L. 1C Leith
Clargo, R. P. .. 2C Cardiff
Cotter, J. N. .. 1C London
Doherty, A H 1C W. Hart'l
Elliott, E W... 1C W Hart'l
Fell, C. F. R... 1C N.Shields
Forbes, Robert 1C Liverpool
Forsyth, Alex. 1C Leith
Frame, William 1C Glasgow
Geddes, Robert 2C Glasgow
Giles, A. E. .. 2C Cardiff
Green, A. E. .. 1C N Shields
Greenfield, J. D. 2C Barrow
Henry, M. R... 1C London
Hindman, R. H. 1C N.Shields
Hood, A. P. .. 1C Leith
Howard, P..... 2C Liverpool
Humble, T. M. 2C N.Shields
Jacobsen, R. H. 2C Glasgow
Jelly, O. H .... 1C Cardiff
Johnston, A. .. 2C Liverpool
Jopling, J. E... 2C South'ton
Kingdom, R. .. 1C South'ton
Law, Joseph A. 2C Leith
Macdonald, R. 2C Glasgow
Martin, David 1C Glasgow
M'Carthy, T. H. 2C W. Hart'l
M'Donald, J. Y. 1C N Shields
M'Larty, A. D. 1C South'ton
Montador, A. .. 2C London
Nairne, D. H... 1C Glasgow
Neild, William 1C Liverpool
Nimms, C. E... 2C Liverpool
Nison, Joseph .. 2C Cardiff
Paterson, John 2C Leith
Rothwell, J. E 2C Glasgow
Scotland, J. S. 2C London
Seys, P. H..... 1C Cardiff
Sibun, R. G. .. 1C London
Speck, G. L. W. 1C W. Hart'l
Teasdale, James 1C N.Shields
Tod, W. S. .... 2C Leith
Tulip, John W. 2C N Shields
Wakeford, C. F. 2C Cardiff
Wilson James 1C Liverpool
Wilson, John R. 1C W. Hart'l
Wright, J. W. 2C Liverpool
Wrightson, T.S. 1C W. Hart'l

August 25th.

Allen, John C... 1C N.Shields
Bailes, John J. 1C Sunderl'd
Barnes, A. M... 1C London
Bilson, Harold 2C Sunderl'd
Booth, William 1C Liverpool
Brockbank, T... 1C London
Brown, G. W. 2C Sunderl'd
Butler, T. G. .. 1C Liverpool
Campbell, T. .. 1C Liverpool
Cannell, J. R... 2C Liverpool
Colman, Edwin 1C Sunderl'd
Dougall, John.. 2C Greenock
Fenwick, R. B. 2C N.Shields
Geer, James H. 2C N.Shields
Graham, James 1C Greenock
Herbert, S. F... 2C London
Holiday, S. G. 1C Liverpool
Hourson, R. M. 1C Greenock
Hughes, James 2C Liverpool
Humphreys, J. 1C Liverpool
Hutchinson, P. 2C Liverpool
Inches, William 2C Hull
Irvin, Hugh P. 1C Sunderl'd
Irwing, George 1C Sunderl'd
Jones, C. W. .. 2C London
Mair, Ernest A. 1C Sunderl'd
M'Farlane, J. A. 2C Greenock
Millree, J. C. E. 2C Greenock
Morrison, V. .. 2C Sunderl'd
Ness, John C... 1C N.Shields
Newton, T. F... 1C Liverpool
Peden, Robert.. 1C Greenock
Press, Albert R 2C Hull
Roberts, R. H. 1C Liverpool
Ross, Charles .. 1C London
Sargent, T. A .. 2C London
Sellar, James .. 1C Aberdeen
Stanley, Otto H. 1C Sunderl'd
Stevenson, Jas. 1C Greenock
Wardle, James 1C Sunderl'd
Wilson, William 1C Aberdeen

September 1st.

Abbott, Robert 1C Glasgow
Alderson, T C. 2C N.Shields
Anderson, J. .. 1C Glasgow
Barron, S. J. .. 1C Liverpool
Caird, C. D. .. 1C N.Shields
Campbell, J. .. 1C South'ton
Carruthers, R 2C Leith
Clarke, Oscar .. 1C Cardiff
Cole, J. E. .... 2C Leith
Collis, M. C. J. 2C South'ton
Cowper, J. E... 1C N.Shields
Croft, T. S..... 1C Liverpool
Day, G ..... 1C Cardiff
Douglass, N. R. 2C N.Shields
Evans, A... .. 2C Belfast
Fiddes, B .... 2C Glasgow
Gibb, T. ..... 1C Leith
Gibson, A. T... 1C Cardiff
Gordon, F. .... 2C London
Harper, W. E. 2C Liverpool
Henderson, H. 2C Glasgow
Jenkins, L. W. 2C Cardiff
Jones, T. ..... 1C Liverpool
Jones, W. R. .. 2C Liverpool
Kypriadis, M... 2C South'ton
Loch, A. B..... 1C Glasgow
Mackinnon, Jas. 1C London
Marshall, F. .. 1C N.Shields
M'Intyre, J. S. 2C Glasgow
M'Laren, W. B 2C Leith
M'Leggan, A... 2C Leith
Moneypenney, J 2C Belfast
Montgomery, M. 2C London
Mordecai, D. J. 1C Cardiff
Neale, J. ..... 2C Liverpool
Neilson, L. G... 2C Glasgow
Oliver, G. H. .. 2C Cardiff
Pollard, C. .... 2C Cardiff
Prentice, H N. 2C London
Rennie, J. N. .. 2C Leith
Robertson, A... 1C Belfast
Robinson, J. C. 2C London
Roche, J. W. .. 1C N.Shields
Ruddock, P.W. 2C N.Shields
Saybolt, S. M... 2C London
Skeoch, John .. 2C Glasgow
Smith, A E. .. 1C Liverpool
Southward, J. S. 1C Liverpool
Storey, G. R. .. 2C N.Shields
Ternan, E. .... 1C Glasgow
Tait, W. G..... 1C Liverpool
Watts, W. .... 2C Cardiff
Webb, A. L. .. 1C Liverpool
Wright, D .... 2C Glasgow

September 8th.

Atkinson, Thos. 2C N.Shields
Bamber, W. .. 1C Liverpool
Bates, L. ..... 1C N.Shields
Bell, J. T. .... 2C N.Shields
Coates, J. L. .. 1C N Shields
Copeman, W. H. 1C London
Hodge, F. C. .. 2C London
Hodgson, W. E. 1C London
Hollingsworth, F. 1C N'Sh'lds
Kermode, R. K. 1C Liverpool
M'Gregor, A. M. 2C N.Shields
M'Gregor, L.W 1C London
Miller, D. W. .. 1C London
M'Queen, A. .. 2C London
Muir, W. J..... 2C London
Newson, A. S... 1C London
Nickels, S. S. .. 1C Liverpool
Ogden, J. T. .. 1C Liverpool
Smith, J. W. .. 2C N Shields
Walker, H. C... 2C N.Shields
Westerberg, P.A. 1C N.Shields
Westin, O. .... 1C N.Shields
Woon, S..... 1C London

September 15th

Atchison, John 1C N Shields
Austin, John .. 1C Greenock
Blanchflower, F. 2C N.Shields
Brown, J. T. .. 1C Liverpool
Clitherow, R. H. 2C Liverpool
Corlett, John J. 2C London
Coursens, P. R. 2C London
Deans, William 1C Liverpool
Douglas, Jos. H. 2C Greenock
Ernshaw, V. R. 1C London
Edwards, H. L. 2C London
Forrest, H R. 1C London
Forrest, Thos... 2C N.Shields
Freeland Wm. 2C Greenock
Gebbie, E. J. .. 2C Liverpool
Godefroy, L.T.T 1C Liverpool
Goodall, John.. 2C N Shields
Hall, E. G. .. 2C N Shields
Hutcheson, Jas 2C Greenock
Keer, M. S..... 1C Greenock
Kite, E. G. A... 2C London
Lonsdale, A. F. 2C London
Macbean, R. J. 1C London
Macnab, A. C. 1C Liverpool
Marriott, J. W. 1C Greenock
Martin, A. .... 1C Greenock
M'Luckie, S. .. 2C Greenock
Morgan, W. S. 2C N.Shields
Morrison, H. .. 1C Greenock
Nicol, A. R. .. 2C Greenock
Paulson, H. P. 1C Hull
Ramsay, J. W. 1C London
Ruthven, M. J. 2C London
Ryles, W. G. S. 1C N.Shields
Simpson, J. R. 1C Greenock
Skitch, G. W. 1C N.Shields
Smith, James .. 1C Liverpool
Southworth, A. 2C Liverpool
Taylor, John .. 2C London
Taylor, R. E. .. 2C London
Thomson, R. .. 2C Greenock
Tiltman, J. H. 1C Liverpool
Wight, D. .... 2C London
Winter, S. .... 1C Hull
Wood, H. J. .. 1C London

September 22nd.

Appleby, T. S. 2C N.Shields
Bagnley, S..... 2C N.Shields
Bastar, F. C. .. 1C London
Bell, E. ..... 2C Liverpool
Bissett, J. F. .. 1C Glasgow
Black, G. ..... 1C Glasgow
Bower, A. T. .. 2C Leith
Byrne, P. A. .. 2C Cardiff
Currie, J. L. .. 2C N Shields
Dickson, W. .. 1C Glasgow
Dykes, A. .... 1C Leith
Evans, T. A. .. 2C London
Gaunt, T. C. .. 1C W. Hart'l
Gemmell, H. .. 1C Glasgow
Gibson, W..... 2C Cardiff
Gibson, W. S. 1C W. Hart'l
Gray, James .. 1C Glasgow
Hallwood, R. F. 2C Liverpool
Harrison, E. S. 2C W. Hart'l
Hewitt, W. D. 2C Glasgow
Hill, W. ..... 2C Liverpool
Hull, W. S..... 1C W. Hart'l
Hunt, T. J..... 1C Cardiff
Jones, D. H. K. 1C Glasgow
Jones, W. W... 2C Liverpool
Kelly, S C..... 2C Liverpool
Laws, H. A. .. 1C South'ton
LeBas, R. E. .. 2C South'ton
Little, J R..... 1C N.Shields
London, John.. 1C Leith
Lunt, T. E..... 2C Liverpool
Manson, W. .. 2C N.Shields
Marshall, P.McF 1C Glasgow
Marston, T. .. 2C W. Hart'l
May, Bernard 1C Liverpool
Metcalf, Henry 1C N.Shields
M'Farlane, C. 2C Glasgow
M'Gruther, J .. 2C Leith
M'Naught, W. 2C Glasgow
Mowatt, R. A. 1C Leith
Murphy, J. F... 2C Cardiff
Nash, V. ..... 1C Barrow
Oldham, Victor 1C W. Hart'l
Owens, L. E. .. 1C Liverpool
Parker, J. .... 2C Liverpool
Phillipson, R. D. 1C N.Shields
Pritchard, J. H. 1C Liverpool
Reith, D..... 2C Glasgow
Roberts, G. McK. 1C South'ton
Roberts, T. J... 1C Liverpool
Rolland, J. .... 2C South'ton
Rose, A. H..... 2C London
Rowe, H. P. .. 1C Plymouth
Smith, E. .... 2C Liverpool
Smith, H. .... 1C Liverpool
Smith, S. C. .. 1C London
Stark, G..... 2C Leith
Strickland, S... 2C Cardiff
Timms, G. L. .. 2C Cardiff
Turner, W. M. 1C Liverpool
Wild, J. T. .... 1C London
Wood, H. E. .. 2C Liverpool

The Marine Engineer and Naval Architect Patent Record.

Compiled by Messrs. E. P. Alexander & Son, Chartered Patent Agents, 306, High Holborn, London, W.C.

12,749. Furnaces. Mechanical stoking.—Comprises modifications in underfeed stokers of the type in which fuel is pushed along a trough by a reciprocating ram operated by a double-acting hydraulic engine. As shown, fuel from the hopper E is pushed along the trough N and on to the side grates M by a cylinder A which is reciprocated on the fixed piston B. The cylinder carries a rod R having pivoted blocks R^1 which tilt upwards at their front ends when the ram is moving towards the furnace. The valve arrangements for the hydraulic engine are shown in Fig. 5. Pressure fluid

FIG. 5.

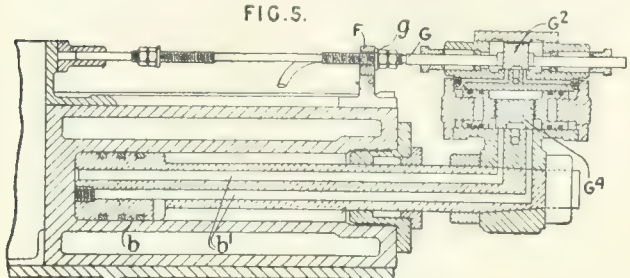
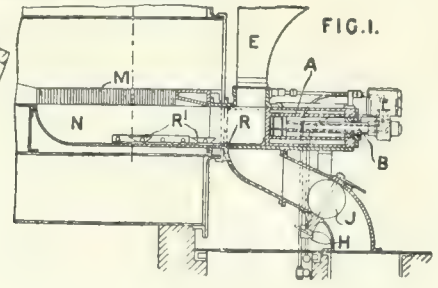


FIG. 1.



is admitted to one side or other of the piston *b* through ports b^1 in the piston-rod under control of a piston valve G^4. This is operated by pressure fluid supplied under control of a slide valve G^2, operated by a bracket F on the cylinder engaging stops *g* on the valve-rod G. The speed of the engine is regulated by a valve H on the exhaust pipe, which is operated simultaneously with the forced-draught valve J. The piston has a larger area for the pressure than the return stroke. According to the Provisional Specification, the air supply, and consequently the speed of the engine, may be regulated by the pressure of steam in the boiler.

12,914. Boat raising and lowering gear. Relates to boat raising and lowering devices of the kind having davits swinging in vertical planes, a horizontal drum shaft mounted rearwards of upright supports and provided with drums at its opposite ends, a single winch device for operating the davits, and cables connected with the drums and passing over pulleys in the upright members and over pulleys in the free ends of the davits. Supports *a* secured to the deck are provided with slotted standards a^2 having at the bottom arc-shaped braces a^4 which are slotted vertically and laterally. Davits *b*, pivoted at *j*, work in the braces and may be secured in any position by operating hand-wheels b^2. To the rear of the supports *a* is journalled a horizontal shaft *e* having at each end drums e^3. Cables *f* from these drums are passed over pulleys f^2 in the standards a^2 and over pulleys f^3 in the davits, and are attached to the boat by means of hooks f^4. The winch mechanism for operating the shaft *e* consists of a central gear wheel *g*, secured to the shaft and provided with a brake rail. A brake band g^5 passes round the hub and is secured to a pivoted link g^5 having a yoke g^6, which embraces a cylinder g^7. A screw g^8 works in the cylinder, and is adapted to put the brake in and out of operation. A crank-shaft *h* provided with handles h^2 carries a loose gear-wheel h^3 gearing with the wheel *g*. The wheel h^3

FIG. 2.

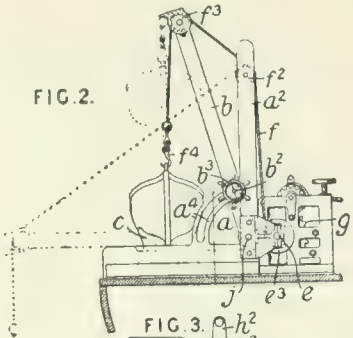
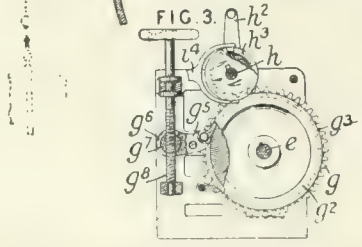


FIG. 3.

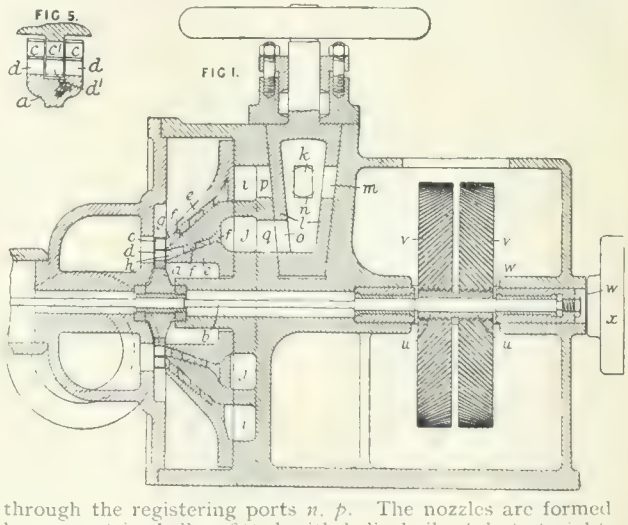


is adapted to be fixed to the shaft *h* by means of a clutch, operated by a fork i^4. In operation, the boat is first raised from chocks *c*. The davits are allowed to fall outboard by loosening the wheels b^3, and the boat is then lowered until waterborne.

14,706. Turbines. A reversible turbine comprises a single vane-wheel of the de Laval type provided with concentric rings of oppositely-turned blades, two sets of supply nozzles leading from two separate steam chambers, and helical speed-reducing gearing. Fig. 1 shows the wheel *a* provided with rings of blades *c*, *d* adapted for opposite directions of rotation, and the nozzles, *g*, *h* supplied with steam from the chests *i*, *j*. A rotary plug-valve *l* having ports *m*, *n*, *o* controls communication between the ports *p*, *q* and the steam-pipe *k*. In the position shown, the nozzles *h* are energized. A quarter-turn of the valve brings the port *m* over the steam-pipe *k*, and the nozzles *g* are energized

FIG. 5.

FIG. 1.



through the registering ports *n*, *p*. The nozzles are formed by concentric shells *e* fitted with helical ribs *f*, but straight, tubular, or other nozzles may be used. In a modification, the ports *p*, *q* are controlled by a piston-valve, and in a further modification by a slide-valve. The turbine-wheel *a* may carry several crowns of vanes as shown in Fig. 5, in which two sets of rings *c*, *d* are shown. The necessary stationary vanes c^1, d^1 are provided. The high-speed turbine shaft *b* is geared by helical reduction gearing *u*, *v* to a secondary shaft *w*, the whole being enclosed in the turbine casing. The shaft *w* has a clutch *x* for coupling the apparatus directly to any machine or instrument such as a ship's propeller shaft, a crane or the like, or a vehicle driving-axle.

The Marine Engineer

And Naval Architect.

LONDON, DECEMBER, 1910.

ELECTRO-MAGNETIC TRANSMISSION FOR MARINE PROPULSION.

THE paper read by Mr. J. Lecoche under the above title at a recent meeting of the Institute of Marine Engineers and which we gave in full in our October issue, forms an interesting addition to the literature of this subject. It must be admitted that the recognised want of some transmitting or transforming gear between the high-speed turbine and the low-speed screw propeller in order to utilize the highest efficiency of each device has been earnestly and seriously attacked by engineers of considerable ability, and we have already had suggested, and in some cases constructed, a mechanical ratio gearing, an electro-dynamic transformation system, and a hydraulic transmission system set out in the fullest detail, and we now have, we believe for the first time, presented a system of electro-magnetic transmission. It will be remembered that Mr. Lecoche describes his arrangement as a magnetic frictionless gear; it consists essentially of two rotating elements of different diameters adapted to rotate in close proximity to one another, the parts of which are of a magnetic character, and are segmentally divided up so as to be easily magnetized from some source of electric current. The effect of this magnetization is to set up a magnetic drag between the two rotating elements so that one drives the other, and if the adjacent surfaces are broken up into segments of a spiral formation you obtain the equivalent of a worm and wormwheel, the driving element of which instead of being the ordinary engaging teeth is a spirally inclined path of magnetic flux. Quite apart from the advantages claimed for this system owing to the absence of friction of mechanical engaging devices, it is claimed that, if such a magnetic gear is used in order to connect up an ordinary reciprocating engine with an exhaust steam turbine, by which, for example, revolutions of 3000 per minute of the turbine are reduced to 75 per minute of the reciprocating engine, should under any circumstances the racing of the reciprocating engine take place no harm would accrue, as the wheel on the reciprocating engine would over-run the wheel driven by the turbine, and the magnetic slip set up would avoid disastrous results. This, of course, appears a very important advantage as far as the description goes, but one would like to have the advantage of observing the behaviour of such a gear on board ship under ordinary working conditions before coming to a reliable judgment as to its commercial value. How often has a scheme when presented on paper appeared to be all that is desirable, but when dealt with in practice shown serious defects which were not previously apparent. We do not say that this is likely to be the case with the Lecoche scheme, but as far as our knowledge goes the scheme up to the present has only appeared on paper, and we are quite certain that judging from the attitude of most ship-owners something more tangible will have to be produced before a substantial advance is made in the adoption of this new system. We should, however, like to congratulate the author of the paper on the ingenuity of his suggestion and we look forward with interest to the practical developments of his idea.

SEAMLESS BOILER SHELLS.

THE tendency in boiler-making, both for marine and land purposes, for a number of years past has been steadily towards abolishing riveting. Marine steam boilers, especially of the Scotch or cylindrical type, have been undergoing changes in construction with this mainly in view. The enlarged dimensions of plates which steelmakers have been able to supply, and the increased calibre of boiler-shop machine tools for dealing with them, have been the main factors in the change. The saving in weight and the obviating of risk through imperfect riveting, as well as the saving in constructional work, are all advantages attaching to the change. It is now the most approved practice to have marine boilers, even of the largest dimensions, constructed with only one longitudinal lap or seam, and without any circumferential seam (unless in long double-ended boilers), except those at the ends necessary for connecting the front and the back plates. Welding by electricity, or by one or other of the gas processes now so much employed, may, of course, also contribute to the abolition of riveted work and extra weight in boilers; but not a few things point to the day being near when boilers of average size may be rolled with precision and marvellous rapidity from the solid bloom at the steelmakers' works. The practical obstacles in the way of this are not insurmountable, and the question of first cost almost alone stands in the way.

Interesting evidence of the possibilities of manufacture in this direction being taken advantage of is afforded by the fact that Messrs. Yarrow & Co., of Scotstoun, are having the steam drums or chests of the water-tube boilers they are fitting into the two British torpedo destroyers they have on hand made seamless and rolled to the requisite diameter from the solid bloom. The first of these steam drums has recently been produced successfully at the Sheffield works of Messrs. John Brown & Co., Ltd. The mill in which this work has been done is of a very special character, and has already been employed producing turbine rotor drums of considerable weight and diameter. The drums made have been of various weights and sizes, the largest as finished being 12 ft. $2\frac{1}{2}$ in.

diameter and of 24 tons weight. The actual rolling of this huge ring or tube of metal occupied only about twenty-six minutes. The boiler steam drums of the Yarrow destroyers are 11 ft. 6 in. long by 4 ft. 2 in. internal diameter throughout. When rolled to the correct internal diameter the drum is $1\frac{9}{16}$ ins. thick, this thickness being necessary in way of the tube holes, but elsewhere over its circumference it is planed down to the requisite thickness for pressure strength.

Besides saving work and obviating the risk of imperfections in riveting, these solid-rolled seamless drums are much lighter with the same strength, and these advantages it is felt — weight-saving in a destroyer being, of course, of great importance — fully justify the extra expense involved by their adoption. With the extended use of such productions, and with experience in manufacture, the cost to users will be much reduced, and so bring nearer the day of solid-rolled boiler shells.

THE NEW CUNARDER.

AS we anticipated the Cunard Company have now announced the fact that they require a new vessel larger than the *Mauretania*, and in addition they have actually invited Messrs. Swan, Hunter and Wigham Richardson, of Wallsend-on-Tyne; and Messrs. John Brown & Co., of Clydebank, to specify for a steamer with a gross register tonnage of 50,000 tons, having a length of 885 ft. 6 ins., a beam of 95 ft. 6 ins., and a speed of 23 knots. This is not a much further step towards the 1000 ft. liner above what is already done by the White Star Company and contemplated by the Hamburg-American Company, but as far as general capacity is concerned the new Cunarder will be larger than the *Olympic* and *Titanic* by 5000 tons, and be on a par with the Hamburg-American. This seems to us to be carrying out a safe and economic policy of progression by reasonable stages, so that the experimental risk is reduced to a rational basis. The new vessel is to be propelled by turbines, and the boilers are to be capable of burning oil fuel as well as coal. The passenger accommodation will be 650 first-class, 740 second-class and 2,400 third-class, making a total of 3,790. As an evidence of the progressive policy in providing increased facilities it is interesting to note that a Turkish bath, a swimming pond and a theatrical stage are among the new features of construction, so that the comfort and recreation of the passengers is being catered for in a most generous manner. It is difficult to properly comprehend the relative sizes of these new vessels in comparison with the present two Cunarders, but the following figures may enable some idea to be formed. Taking the *Mauretania*, the *Olympic*, the proposed Hamburg-American and the proposed Cunarder, in this order the gross register tonnage is 32,000, 45,000, 50,000 and 50,000; the length in feet is 762, $882\frac{1}{2}$, 881 and $885\frac{1}{2}$; the breadth in feet, 88, $92\frac{1}{2}$, 100 and $95\frac{1}{2}$; and the speed in knots, 25, 21, 22 and 23 respectively. From these figures it will be seen that the new Cunarder and the Hamburg-American vessels will each be 11% larger in register tonnage than the *Olympic* and 56% larger than the *Mauretania*. This development tends to show more strongly than ever that the big ship will be the carrier in the future, anyhow, so far as main lines of traffic are concerned. To the man in the street the cost of these leviathans can convey little commercially: for instance, it is contemplated that the new Cunarder will cost two millions, but a reasonable return on such a huge capital expenditure is difficult to appreciate in any abstract sense; however, we cannot think that such an expenditure would be made by a body of business men unless it were done on a sound commercial basis.

THE BROWN-CURTIS TURBINE.

WE gather from an account given in our contemporary, *Engineering*, that the results obtained from the installation of the Brown-Curtis turbines in H.M.S. *Bristol* are not only very interesting in character, but we venture to think may have a far reaching effect in turbine-driven ships.

The Admiralty have been extremely careful in obtaining information during every step of development in the adoption of the turbine system during the past ten years, and the result of their policy has been that the "Parsons" type was considered the only one satisfactory and worthy of adoption up to the date of settling the machinery for H.M.S. *Bristol*. However, Messrs. John Brown & Co., Ltd., who have taken up the manufacture of the Curtis turbine were able after careful investigation and practical experiments to prove to the Admiralty the desirability of adopting this impulse type of turbine in the new class of cruiser of which H.M.S. *Bristol* is representative. It may be stated that the primary reasons on which the advantages of the Brown-Curtis turbine are based may be summarised as the use of superheated steam in the turbine of the "Impulse" type, the absence of closely fitting parts and the consequential fine adjustment necessitated thereby, while at the same time obtaining high economy at low powers, and lastly, but not least, the general simplification of the machinery in the engine room and the connections relative thereto. We understand that the ship attained a mean speed of 26·84 knots with a mean shaft H.P. of 24,227 during the eight hours' trial. On the four earlier vessels fitted with turbines of the "Parsons" type the mean shaft H.P. was 23,800, and the average of the mean speeds was 26·13 knots. On the same ships, when the shaft H.P. was 18,650, the average of the two mean speeds on the measured mile was 24·98 knots, while on the corresponding trial of the *Bristol* the shaft H.P. was 19,130, giving a speed of 25·17

knots. Taking another basis of comparison, during 22 hours' trial the average of the mean speeds of the four shafts during such trial was 14,016 shaft H.P., giving the average of their measured mile speeds of 23·56 knots, while the *Bristol's* mean power was 14,300 shaft H.P., and the measured mile speed 24·06 knots. These results fully justify the Admiralty in the departure they have made in fitting the Brown-Curtis turbine to the *Bristol*.

THE INTERNAL COMBUSTION ENGINE, by Mr. William P. Durtnall. During the reading of Part II. of his paper at the Institute of Marine Engineers, on Monday, November 28th, Mr. Durtnall introduced an interesting system for making gas in connection with suction gas engine driven ships. The novelty concerning this is the fact that either crude oil or coal may be used.

THE BRUSSELS EXHIBITION.—Although this Exhibition was closed last month it may be well to recall a few reminiscences connected with it which appealed to us, prior to the closing scenes. For instance, the re-opening of the British section, when made good after the fire, was the occasion of an interesting demonstration calculated to knit kindly sympathy between the national promoters and Belgium as a whole and the British exhibitors, which may, it is hoped, extend beyond the confines of the Exhibition, and serve to cement friendliness between the nations. King Albert of Belgium was present, and Sir Arthur Hardinge, on behalf of Britain, expressed thanks for the interest taken by the King in the re-opening ceremony, and in responding the King congratulated the exhibitors and the British Government for the promptitude and energy displayed in making up the section so well, in order to preserve the Exhibition as complete as possible during the remainder of the time it was to remain open. The devastation caused by the fire was visible in the background to some extent, but the erections and ornamentations replaced along the front and side served to sweeten the appearance to the eye of the visitor not too curious to behold the twisted ironwork and debris strewn behind. The grounds of the Exhibition were laid out artistically and gave a pleasurable sensation to the visitor, and although the Exhibition proper was closed at 6.0, the grounds remained open and provided a promenade amid lamps and festoons which tempted large numbers to remain and run the risk of reaching Brussels by late cars. The system of having compartments in the grounds marked opposite which the special car desired stopped to embark passengers was in operation, and prevented crushing. The car system inside the grounds was also good, and by taking advantage of it, the visitor, on first entering, had a good opportunity of noting the various portions which appealed to him as specially worthy of a closer examination, thus saving time when only a brief visit was contemplated or possible.

THE BED OF THE OCEAN.—On the occasion of the presentation of the Royal Scottish Geographical Society's medal to Professor Geikie for his well-known work on research in connection with geology, Sir John Murray, to whom the Livingstone medal was awarded, delivered an interesting address on the ocean. Referring to the means which had been used to discover the conditions existing in the various seas, the currents, depths, species and habits of fishes, the variety of material found in the ocean bed, a tribute was paid to the private enterprises which had contributed to the knowledge of the world; commenting on the observed data showing that the bed of certain seas appeared to take on a deposit of an inch in ten years, and that the ashes from steamers lay thick on certain routes amid shells and other deposits, it was suggested that at a distant period of the future observers might find in the buried ashes evidence to show to the then generation what had been in the first ages of the world's life. The Earl of Stair presided and presented the medal to Prof. Geikie, that to Sir John Murray was was presented by Mrs. Livingstone Bruce—daughter of the distinguished missionary traveller.

THE GERMAN BATTLESHIP-CRUISER "VON DER TANN."

BUILT as a reply to our "Invincible" class, the *Von der Tann* represents Germany's initial effort in the construction of vessels of the battle-cruiser type, and is certainly the most interesting warship at present in the Teutonic fleet. Unlike the battleships of the "Nassau" type, the *Von der Tann* exhibits none of those mistakes in conception and design which so greatly detract from the fighting value of the former ships; there is no attempt to cram a huge armament into insufficient hull-space, the disposition of the guns being such that the same weight of fire can be brought to bear on all points as in the *Nassau* with her four extra guns. Again, whilst the battleships suffer from inadequate ammunition supply, float at, at least, a foot more draught than was designed and cannot accommodate their crews comfortably, the *Von der Tann's* guns can be well fought, she can steam some three knots faster than her paper speed and her open decks and well-spaced living quarters are all that could be desired from both a utilitarian and a hygienic point of view.

Laid down at Messrs. Blohm & Voss' yard, Hamburg, on March 25th, 1908, the *Von der Tann* was launched on March 20th, 1909, commissioned for trials on April 24th, 1910, and entered the service on September 1st. Until a few months prior to her trials, no authentic details as to her armament and general design could be obtained, with the result that she was credited with a higher fighting value than she actually possessed. Thus, in 1907, "Fighting Ships" gave her, with all reserve, an armament of twelve 11-in. guns so arranged that all could be fought on either beam, and eight axially—particulars that were generally accepted as approximately correct. The following year, however, the gun-power had fallen to eight 11-in. mounted in the position in which they actually are—a bold piece of prophecy, but one which did not influence the fixed belief that the ship would carry a heavier armament than this. In 1909 there was still uncertainty as to her design, and the alleged armament had risen to ten 11-in., disposed as in the *Dreadnought*. That summer the writer had an opportunity of inspecting the ship, and although a profusion of awnings covered the greater part of the hull, the presence of a main-deck secondary battery could be ascertained. Last spring the four big turrets postulated an armament of not more than eight 11-in. pieces, although previously the addition of some dummy turrets—or covered-in erections that could be mistaken for them—had obscured the actual gun positions and design.

From the illustration and plan herewith it will be seen that the design is similar to that of our own *Indefatigable*, there being two axial and two diagonally placed turrets each carrying a pair of guns. The wide spacing of those amidships is, of course, a great improvement upon the cramped distribution of the corresponding pieces in the earlier ships of the "*Invincible*" class, whose "off-side" bearing is very restricted. The 6-in. main deck battery is characteristically German, but differs from that of the *Nassau's* inasmuch as the hull is not recessed forward to allow of axial fire for the first pair of guns; consequently, although their arc may be restricted, the guns are certainly drier in a sea-way.

The following table sums up the characteristics of the English and German ships:—

	Von der Tann.	*Indefatigable.*	*Invincible.*
Length (overall)	500 feet	580 feet	502 feet
Beam	87 ,,	80 ,,	78½ ,,
Draught (mean)..	26¾ ,, ..	27¾ ,, ..	26½ ,,
Displacement (normal)	18,700 tons* ..	19,200 tons ..	17,250 tons
I.H.P. (designed)	41,000	45,000	41,000
Speed	25/28 knots ..	26/30 (?) knots	25/2 knots
Belt armour ..	6-7 in. ..	8 in. ..	7-4 in.
Big gun	8 in.	12 in.	10 in.
Armament	8 11-in.	8 12-in.	8 12-in.
	10 5·9 in.	10 4 in. ..	16 4-in.
	16 3·4-in.		
Torpedo tubes ..	6 ..	2 ..	5
Coal	1000/2800 tons	1000/2500 tons.	1000/3000 tons.
Total cost	£1,833,000 ..	£1,547,426 ..	£1,725,000
Cost per ton ..	£98 .	£80·5 .	£100

*Full trial displacement over 19,000 tons.

From which it may be seen that the German ship exhibits no very wonderful features, although an almost theatrical secrecy was observed over her construction and her designers were credited with being able to produce a design possessing on a smaller displacement a more powerful armament, better protection, greater speed and a general all-round superiority over our own contemporary ships.

Let us see exactly on what points the Germans have improved on the "Invincibles." In the first place, the German 11-in. gun, although an excellent weapon, cannot claim to be the equal of our latest 12-in., and for this reason the British ship may be considered more powerful as regards primary armament. Incidentally, the alleged superiority of the German guns over the British cannot be sustained when the full facts are considered. In the first place, our 12-in. projectile weighs 850 lbs. against the 760 lbs. of the 11-in., and has a muzzle energy of 49,568 foot-tons compared with 42,435 foot-tons of the German piece. Both have the same rate of fire (two rounds per minute). If the 11-in. has any advantage it is with regard to its "life," but here it is difficult to obtain unbiassed and official data for comparative purposes.

By reason of the wider spacing of her guns, the *Von der Tann* can bring the off-side couple to bear through a slightly wider arc than can the *Invincible*, but as the results of cross-deck firing are attended with excessive strain on the deck and hull side below the guns, the additional arcs of bearing—which are exceeded in our *Indefatigable*—need not be counted for much. Against this, the amidships guns on the *Invincible* are a deck higher than those corresponding on the *Von der Tann*—a factor of great importance as regards "command."

By virtue of her heavy secondary battery of 5·9-in. and 3·4-in. guns, the German ship may be considered to be the better protected against torpedo-boat attack, but it must always be borne in mind that a main-deck battery is of little use in a sea-way because of its restricted command, while the 3·4-in. guns mounted in the bows and stern are not going to be fought in all weathers. Consequently the British 4-inchers high up on the turret tops and in the super-structures may in actual practice prove as efficient a protection as the more numerous but less advantageously placed German guns.

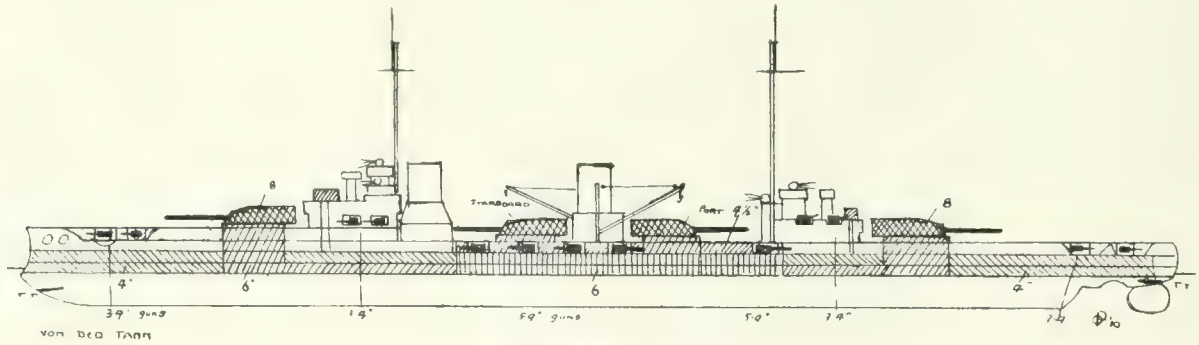
The *Von der Tann* has not proved to be so well protected as was originally supposed. Her main 6-in. belt extends along that section which lies between the two end turret bases, the bow and stern continuations being 4 in. The *Invincible* has a more extensive 7-in. protection, and the 4-in. extension goes up to the stern post, which the *Von der Tann's* does not. Compared with our 10-in. turrets, the 8-in. protection to the German big guns seems light. The main-deck battery is said to have 4½-in. armouring, but this is uncertain; the protective deck is 2½ in. thick, the *Invincible's* being 3 in.

With a designed H.P. of 41,000, the *Von der Tann* was expected to steam about 24½ to 25 knots. On trial she developed 70,000 and touched 28·128 knots, with a mean of 27·4 for six runs—a result which at first sight suggests superior steaming powers over the *Invincible's* until the conditions in each case are considered. In the first place, the German ship was forced to her utmost, as the 11 lbs. of steam per shaft H.P. recorded gives 880,000 lbs. for the turbines alone, and to this must be added some 15 per cent. for auxiliaries—a total of 1,000,000 lbs. per hour, which is about what the *Mauretania* averaged. To attain this result the coal consumption amounted to 62 lbs. per square foot of grate surface (1950 square feet) per hour. When it is remembered that she has only two funnels, the wear on the uptakes must be excessive, and bound to lead to their being rapidly burnt out. Now the three "Invincibles" each did over 28 knots, and have maintained their trial speeds of 26 knots for twenty hours on end during recent manœuvres—the *Invincible* herself did 26·6 knots in a gale off Polperro, while the *Von der Tann* ran her trials in perfectly calm weather on a picked stretch of water. It is, therefore, evident that the British ships are the more likely to prove the faster sea-boats, they as yet not having been run at their maximum pressure, which might conceivably result in their touching 29 knots.

To sum up, therefore, the British ships must be awarded the palm for superiority in big guns, speed, protection and general sea-keeping qualities, while the German may have slightly the better of it with regard to her secondary armament and all-round concentration of fire.

In appearance the *Von der Tann* is not nearly so imposing as the British battleship-cruisers with their huge funnels, tripod-masts and continuous high freeboard. Her superstructure forward is mostly canvas and railings, whilst owing to the funnel tops being on a level with the searchlight platforms, deck-houses, etc., there is sure to be the same trouble with smoke in a following wind as caused the funnels of most of our new cruisers to be raised from 6 to 15 feet.

There is a complete absence of ventilating cowls, etc., the peculiar funnel bases having been utilized as great air shafts, hence their unique appearance. As a consequence of the turret spacing, the number of boats carried is very limited, and these are stowed in inconvenient places by the funnel bases—possibly some may be carried on the amidships turret tops, but this is not certain. The *Nassau* carries some small boats on the after amidships turrets, and *faute de mieux* the *Von der Tann* may do so as well. Incidentally it may be mentioned that the very latest British ships will carry their boats under cover out of harm's way.



Plan of the *Von Der Tann*

The main-deck torpedo net defence is an innovation as regards German cruisers, the *Nassau* being the only other ship in the fleet to be so fitted. The present pattern of net and fittings is said to be somewhat cumbersome and unwieldy.

Owing to rapid development in design, the *Von der Tann* is likely to remain the only unit of her type, as the *Moltke*—now completing for sea—and subsequent vessels are much larger and more heavily armed. They will not, however, bear any comparison with the *Lion*, *Princess Royal* and the ships to be built under the current programme, as these will carry the new 13·5-in. gun as against the 12-in., or possibly 11-in. of the Germans.

Shipbuilding Returns for 1910.—In our January number we shall publish as usual the Shipbuilding Returns of the world, giving details of all vessels launched and engined during 1910. This is the most exhaustive list published and has been a feature of this journal for thirty years past. The number is a double one, and, in addition, will contain many original articles.

THE GERMAN BATTLESHIP-CRUISER "VON DER TANN."

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

New Atlantic Ports.

TWO old projects for the alleged shortening of the Atlantic passage have recently been revived.

The first of these is that put forward at the general meeting of the Midland Great Western Railway of Ireland at the beginning of November, when it was sought to obtain the sanction of the shareholders to an expenditure of five thousand pounds for preliminary expenses in respect of an attempt to revive the glories of Galway as an Atlantic port. The total amount required to promote the necessary bill in Parliament was said to be £20,000, of which another £5000 would be found by Messrs. S. Pearson & Sons, the well-known contractors. The eventual expenditure under the proposed bill was not mentioned. But it would evidently be a considerable sum, as the scheme involved the construction of a deep water harbour at Barna, three miles from Galway, and the making of a short railway to link that port with the main line of the Midland Great Western system. Galway seems to be nearly three hundred miles nearer Canada than, say, Liverpool, and that advantage cannot be gainsaid. But it must be remembered that, as the port is on the middle of the west coast of Ireland, steamers calling there would have to make a deviation of many miles from their direct course to English ports, whether they were taking the Northern or the Southern route to their destination. Herein Galway is at a disadvantage to its rivals. Queenstown and Fishguard lie on the direct line between New York and the Mersey, whilst Continental-bound ships pass close to Southampton and Dover, even when they do not call at those ports. Barna is a hundred and thirty miles from Dublin, and when Dublin is reached there is—as I found myself the day preceding the meeting—an unpleasantly rough stretch of sea before the traveller finds himself at Holyhead. Briefly, the disembarkation at Galway means a considerable deviation to the steamer, and to those passengers who proceed in her to the terminal port, and a journey of at least thirteen hours, involving two changes—one of them to a steamer—before London can be reached. The White Star Company has just found that experience does not justify a call at Holyhead. Galway means a journey of which Holyhead is only the first and easiest of three stages. Is public memory so short that the disastrous attempt to make Galway into a port forty years ago has been entirely forgotten? If it is, it may be worth while for me next month to give a short history of the troubles and losses of the old Atlantic Royal Mail Company.

The other scheme stands on a somewhat different footing. Its promoters propose to make Montauk Point, Long Island, a terminal for the new Atlantic vessels now under construction for the White Star Company. That there will be a difficulty with these ships at the present New York piers seems certain. For they will project a hundred feet into the North River and the authorities will not allow further lengthening of the piers. The construction of a deep water pier at Montauk Point, therefore, has much to recommend it. A hundred and thirteen miles nearer Europe than their present terminus, the ships using it would avoid the more crowded waters at the Western end of their journey and would thus be probably enabled to maintain their full speed almost to the last. New York passengers would find that a couple of hours railroad journey was substituted for the last six or seven hours of their steamship voyage. This would mean, of course, an additional change for them. But for other places than New York, such as Chicago, Philadelphia, Boston, and the hundred important towns to the South, West and North of New York no additional change would be necessary. They have a railroad journey now, and they would have it still. A couple of hours added to it in the luxurious through trains of the American continent would hardly be noticeable, and would certainly be a small price to pay for the economy of the ocean trip. Similarly with goods from the interior of the Continent, the addition of a hundred miles or so to the railroad journey, if it did not involve an additional transhipment, would be quite unimportant. The Montauk project failed twenty years ago because it could show no appreciable advantage over New York and because it involved additional changes. Now the situation is quite altered. Montauk can adapt itself to the accommodation of the new leviathans as New York apparently cannot do. The building of the railway connections across the New York rivers has thrown Long Island into the Continental railway system, and the additional changes of conveyance are no longer essential. For these reasons the Montauk scheme is far more likely of realization than are the hopes of those who would see Galway the gateway of the West.

The White Star Line

is credited with other designs for next season than its promotion of the Montauk scheme. It is said to have found the success of its service to the St. Lawrence to be so great that it has decided to make the sailings, now fortnightly (as far as its big liners are concerned), into one which will each week provide a sailing by a steamer of the type of the *Laurentic*. Where exactly these ships are to come from one cannot quite foresee. There must be a re-arrangement somewhere in the complex system of the Combine, and the New York-Mediterranean trade would appear to be too successful for the managers to deprive that service of two steamships of the *Republic* type.

The Port of London Authority

has now issued its first annual statement. What chiefly interests me in this voluminous document is the justification which is given to all the criticism which in this column was poured out upon the directors for the continued starvation of the dock estates by the Boards of the various companies. The chief engineer has, it is said, reported "that generally they (the docks) have not been maintained in a proper state of repair and that to ensure the efficient and safe working of the undertaking a large and immediate expenditure was absolutely necessary."

The estimated cost of putting things straight is not far short of three-quarters of a million sterling. It may be well to show how it is allocated amongst the different estates, that have now come under the central management :—

London and St. Katherine	£90,560
East and West India	150,240
Victoria and Albert	265,652
Tilbury	86,448
Surrey Commercial.....	80,884
Millwall	61,827
Total	£735,611

The West African Service.

For some time there have been rumours of an agreement between the Elder, Dempster and Woermann Lines to West Africa. The foundation for these reports now becomes apparent. A new company with a capital of 10,000,000 francs, say £400,000, has been formed at Antwerp to run a line of steamships from that port to the Congo. The constituents of the new organization are the Hamburg, Woermann and Elder, Dempster Lines. That the Woermann and Hamburg companies were friendly has been known for some time, but the agreement with the British companies is quite a fresh feature. The new venture is to make its first sailing on the 1st February next.

Brazilian Steamship Companies.

A new departure has been made by the Brazilian Lloyd which last month instituted a service between Liverpool and Rio with its twin-screw liner *Minas Geraes*. On the other hand, there seems a possibility that the service of the Amazon Steam Navigation Company may be restricted or even abandoned. For the company's contract with the Government expired at the end of July, 1910, and it has not proved possible to obtain a renewal on terms at all acceptable to the company. The directors have arranged to carry on the company's services till the end of November, but they do not propose to do so after that date—save, of course, on their own terms—and accordingly they are summoning an extraordinary general meeting in order to obtain powers to dispose of the assets of the company should a suitable opportunity occur.

The Hamburg-American Line.

In last months' notes I mentioned the approaching removal of the steam yacht *Oceana*—formerly the Union Liner *Scot*—from the fleet list of the Hamburg Company. It now transpires that the purchasers are a new company who propose

to employ her in the rapidly expanding passenger business between New York and Bermuda, and that the price paid for her was £40,000. Meanwhile, her late owners, determined not to relinquish their hold on the public yachting business, have sent the fast liner *Deutschland* to Stettin to have certain of her boilers taken out and otherwise to be adapted for her new career as a cruising vessel instead of a fast mail carrier.

Wireless Telegraphy.

The new management of the Pacific Steam Navigation Company has given orders that the mail and passenger steamers employed in the trade between Liverpool and the West Coast of South America are to be fitted with wireless telegraphy, and accordingly the *Oropesa*, the first vessel to be so fitted, left the Mersey in November, having received her installation during her three weeks' stay in her home port. South America indeed is rapidly being supplied with wireless stations. Signor Marconi himself paid a visit to the Plate during the autumn now closing, and availed himself of the opportunity afforded by his trip to make certain interesting experiments in the use of kites in wireless signalling in the course of his voyage. An agitation has been raised in the diminishing ranks of British sailing shipowners to have a wireless station erected in the Falkland Islands, so that reports received there from the numerous sailing vessels which call there can be transmitted.

In the Australian trade, too, another company—the Aberdeen Line—has adopted Marconi's invention and has given orders for the equipment with wireless of the three steamships *Miltiades*, *Marathon* and *Moravian*, of those of their steamships already at work, whilst the two new vessels now under construction at Messrs. Harland & Wolff's will be similarly fitted before delivery to their owners.

The Bibby Line

having received delivery of their new steamship the *Gloucestershire* from Messrs. Harland & Wolff, have disposed of the oldest vessel of their fleet—the *Cheshire*—built as recently as the year 1891. She has been purchased by a Rangoon shipowner and renamed by him *Seang Choon*.

HUHN'S IMPROVED TUBE-CLEANER.

FOR the past ten years the tube-cleaner put upon the market by the Huhn Tube-Cleaner Manufacturing Company, of 11, Queen Victoria Street, London, under the title of the "Turbinia," has met with a large amount of success in dealing with deposit in boiler tubes. The device is a rotary one, carrying cutters and operated by water or air, which at the same time carries away the deposit removed by the cutters. The cutters are mounted on arms which, under the action of centrifugal force, fly outward against their work during the cutting action of the cutters.

However, as time has gone on practical experience has shown that objectionable conditions arise owing to the access of water to the ball bearings supporting the cutters' arms, and such water at high pressure drives the lubricant out in a few seconds. Further, the rate of revolution of the cutters being some thousands per minute, and the pressure of water used being at least 150 lbs. per square inch, the strain thrown on the head bearing of the cutter amounts to about 880 lbs., consequently the wear on the bearing discs, ball races and balls is very considerable, and the resulting enlarged clearance produced materially reduces the mechanical efficiency of the water guide and turbine wheel. These features are much accentuated when the distance between the ball bearings is short. To appreciate these points we refer the reader to Fig. 1, which illustrates the original design of the apparatus.

In order to overcome these difficulties the apparatus has now been re-designed in the form shown in Fig. 2, from which it will be seen that the rotating head is mounted on its ball bearings, so that all water is effectually excluded, while an oil reservoir is arranged at the head of the apparatus surrounding the top bearing and lubricating both it and the lower bearing; in fact, the water exerts a sucking action on the lower bearing, and tends to draw the lubricant through the holes in the axle provided for its passage.

The distance between the ball races has been increased to about three times the original distance, thus affording a thoroughly substantial and durable bearing. The apparatus is easily manipulated and is always ready for use, and merely needs connection by a one-inch armoured rubber hose to a feed nozzle on force pump capable of giving a water supply of about

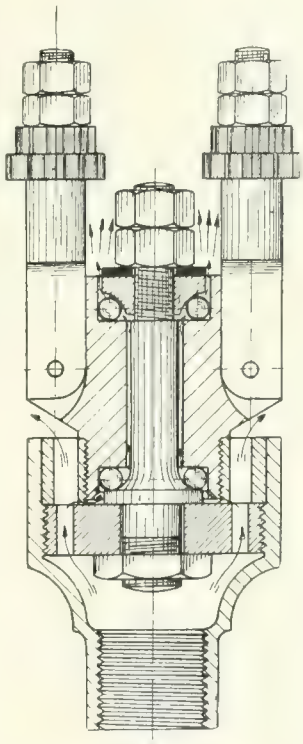


Fig. 1

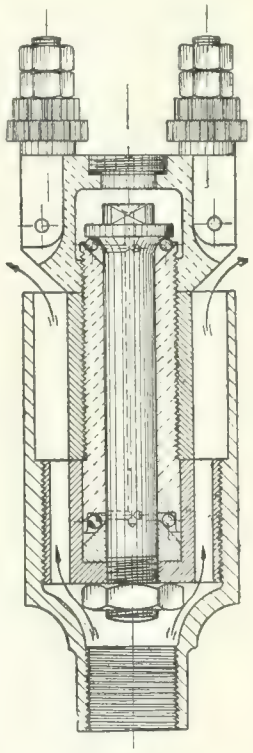


Fig. 2

150 lbs. pressure. When the cutter head has been inserted into the tube the water is turned on, and the head is revolved thereby owing to the turbine construction of the cutter head. The cutters are loosely mounted on their carrying arms and are driven outwardly by centrifugal force against the material deposited on the walls of the tube. The exhaust water, after passing through the turbine, not only cools the cutters, but at the same time carries away the material removed. The apparatus when working sets up a certain amount of vibration which materially assists the removal of scale. A prominent feature of this cleaner in connection with marine boilers is that it can be made for small tubes down to 1 inch internal diameter, also for slightly bent tubes. It can further be used in awkward places difficult of access, such as are often found on board ship.

THE INTERNAL COMBUSTION ENGINE.*

PART II.

By MR. WILLIAM P. DURTNALL (Member).

IN selecting the title of this paper the author was well aware that the subject could cover a great volume of technical matter, in fact much more than would be in order with the objects at issue. Thousands of different designs and types of prime-movers have been investigated by engineers all over the world, during the history of this important power, and with ever-increased efficiency both in design and operation. A tremendous impetus has been given to the building of small power boats and other means of utilization of power by the great improvements in the internal combustion engine. This engine may employ either petrol or similar volatile spirit, petroleum, alcohol or producer gas. Steam has had a good long innings, and has been developed through years of practical experience, so that though it cannot be said to have reached finality, yet no startling developments are to be anticipated. On the other hand, the internal-combustion engine is of recent growth, and its rapid advance towards perfection during the past few years gives promise of still greater possibilities.

In considering the pros and cons of steam,we have fairly reliable and conclusive data to go upon, without making too great reservations as to the future. The great points upon which this form of prime-power claims the attention of shipowners, or would-be owners, is its proved freedom from breakdowns, due to the more or less exact knowledge which has been obtained from many years of experience. The perfect flexibility of the engine, from the maximum number of revolutions down to practically zero, giving easy control and reversing, its economy in fuel, quietness in running, and simplicity of construction. On the other hand, the machinery takes up a considerable portion of valuable space in the best part of the boat, and coal is dirty to handle, either in getting on board or in putting same into the furnace, so that men have to be employed and carried for this purpose ; further, valuable time has to be spent in getting up steam before proceeding on a certain voyage. This is considerable in large ships, although in small pleasure craft as little as ten minutes can accomplish this latter duty, especially where liquid fuel is used for raising steam. Liquid fuel is cleaner to use and does not require so much attention, but its cost is much higher for steam raising than coal; on

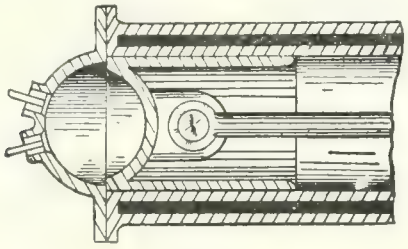


Fig. 1.

the other hand, petrol is dangerous and expensive to run, but easy to start ; petroleum is cheaper and comparatively safe, but unless used in certain types of engine causes delay in starting, whilst producer gas is safer and cheaper still, but in some designs is yet heavy and cumbrous and takes time to start. Taking the whole line of types into consideration, it can be safely put down that on the matter of ready starting the petrol engine comes in an easy first, and in a certain type of speed boats its application is desirable from many aspects, its light weight per horse-power developed, which must be of great advantage in those cases where boats have to be hoisted in davits; it also permits of less displacement and should consequently give greater speed per horse-power, and the small amount of space taken up. Therefore, allowing a power installation in a very small and low-priced boat, and bringing the possibility of a power-driven boat within the reach of those that, although desiring power, perhaps could not afford the larger size and cost of steam, its comparative cleanliness and small amount of attention required whilst running, cheapness for small sizes, and other advantages have made this class of internal-combustion engine popular. On the other hand, it is liable to a number of derangements, to many, of a puzzling nature, is rather noisy unless a proper installation is carried out, only got by experience, and petrol is so dangerous on account of its inflammability, as to make its application prohibitive in, say, cabin boats.

A few points in connection with this class of simple prime-mover of the four-cycle type will not be out of place in this paper, especially to those who have not been fortunate to have had experience with them. By far the greater proportion of internal-combustion petrol engines are constructed on what is known as the water-cooled cylinder type, and Fig. 1 shows a section of such a cylinder, having a spherical clearance head, and a depression on the piston head ; the shaded portion at top and bottom indicate the water jacket space, in which the cooling or circulating water passes, to carry away the excess heat from the cylinder walls. The circulating water used is assisted by means of a pump, driven from the engine crank shaft, and coupled to a supply tank

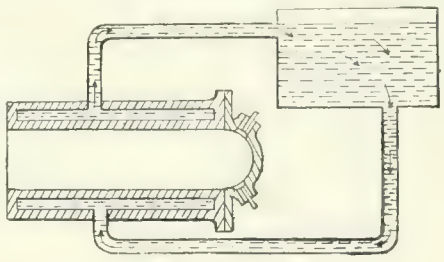


Fig. 2.

and radiator, to dispose of the heat units to the atmosphere. Fig. 2 shows the method of coupling up same, and the path of the water circulation and working on the thermo-syphon system. As before stated, the reason why the petrol engine is such an easy starter is the fact that petrol vapour is given off at a much lower temperature than the heavier oils, and it is obvious that by bringing a quantity of air at a high velocity past a small jet in which the petrol is present that the vapour will be given off and mix with the air, and thus form by proper adjustment an explosive mixture. Fig. 3 shows the action of a so-called carburetter, or mixer. It will be observed that A is the hollow float carrying a small needle

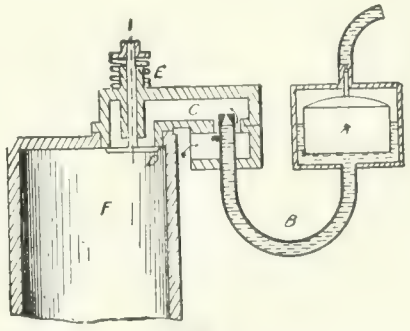


Fig. 3

valve at the top, which does the duty of closing the supply of petrol from the supply pipe, should for some reason the fuel consumption be reduced either by slowing the engine or on being stopped, etc. ; its duty is, therefore, that of keeping the level of the petrol in line with the top of the jet in the air-way on its passage to the cylinder, drawn in under the suction of the outgoing piston. B is the connection between the float chamber and the jet, C is the spraying nozzle or jet as it is more usually called, and it will be at this point noticed that the air comes in through the small way under the jet chamber, as will be seen by the arrow mark ; the inlet valve is shown at D, which opens inward against the spring E, which closes the valve on the pressure in the cylinder F again getting back to that of the atmosphere. On the

* Read before the Institute of Marine Engineers on Monday, the 28th November, 1910.

For Part I. see October issue of *The Marine Engineer and Naval Architect.*

return stroke of the piston the inlet valve as shown, closes and Fig. 4 shows how the compression is raised, and the petrol further atomized by the rise in temperature that also

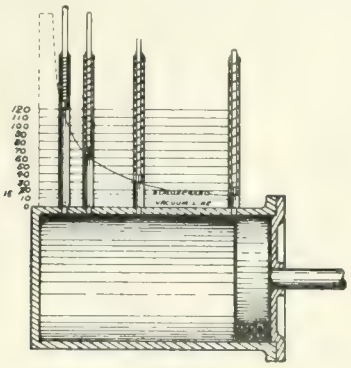


Fig. 4.

takes place under this compression. It will be observed that half-way through the stroke the pressure increases above that of the vacuum line to approximately 30 lbs. per square inch, and that at three-quarter stroke the pressure is about 60 lbs., and at seven-eight stroke the pressure is 120 lbs.; the energy to carry this into effect is given off by the action of the flywheel. The next, or third stroke, is that which is known as the working stroke, in which the compressed explosive mixture is fired by means of, say, an electric high-tension spark, commonly known as electrical ignition, the mixture immediately burns and the temperature also rises to a high degree, the crank being now on the outward stroke again the piston is driven forward under the influence of this superior pressure; the fuel is burnt, the pressure raised, and the expansion stroke has commenced as in a steam engine. Fig. 7 in part I. of this paper shows a diagram taken of an engine during this stroke; it will be noticed that at B, on this diagram, the piston has arrived at approximately the end of the stroke, but that the expansion is not complete. The exhaust is positively opened, whilst a good portion of the pressure formed by the explosive mixture is still available; this is sheer waste, and in the author's opinion this is to be investigated and utilized in the early future, by means of a suitable gas or exhaust turbine. As the matter stands to-day this good pressure is simply turned into the atmosphere, which is the cause of the noise that has been previously referred to, or it is taken into what is termed an exhaust or expansion box, and so arranged that the gases are expanded to no purpose before being allowed to reach the atmosphere, it being obvious that if they were to arrive

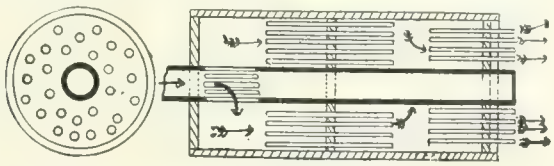


Fig. 5.

at the same pressure as that of the atmosphere there would be no noise.

Fig. 5 shows such an exhaust box, and it will be observed that the exhaust gases still under pressure are delivered to the inlet as shown by the arrows; they are expanded by coming out of the pipe by means of the slots shown, into the space in the front of the box, they then find their way at lower velocity through the small tubes fixed in the centre division, and thus they arrive at the second chamber for still further expansion, then through the small tubes that lead them to the atmosphere, where they arrive usually with a loud report, especially when the engine is under full duty. During this period, and whilst the contents of the cylinder are thus being disposed of, the piston has returned to the end of the cylinder again, which formed the fourth stroke of the cycle and is usually termed the four-cycle or stroke engine. The cycle is again repeated and continues, and Fig. 6 shows two diagrams taken from a normal engine, under service conditions; the bottom one shows the engine under approximately half load and the top one shows the engine under full load; both exhibit the variations in the pressure and expansion curves, usually noticed in consecutive explosions, and they show three successive strokes each.

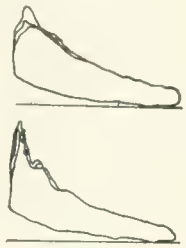


Fig. 6.

As regards carburetters, there are a large number of different types on the market, the best of which are those which provide a means whereby a rich mixture can be obtained when the engine is running at a low revolution speed. In the ordinary way the velocity of the air will, of course, be lower, and the petrol is, therefore, not drawn off quickly enough to form a proper explosive mixture, consequently the same is not in right proportion and is not fired by the spark and the engine usually stops from that cause. But there are what are termed automatic carburetters that reduce the area of the air inlet and thus increase the velocity of the air on its way to the cylinder, so that more petrol is drawn off and the right mixture is formed, and thus the engine will under these certain conditions run at a variable speed, but not with the same fuel efficiency, which, as previously pointed out in my paper on electrical power transmission, is one of the defects of many of the internal-combustion engines that have been proposed for marine propulsion; the internal-combustion engine, like its twin brother the steam turbine, is a machine that as regards fuel economy has only one revolution speed at which the maximum of work can be performed with the least amount of fuel.

Engineers who have had experience with American two-cycle engines have come across the mixing valve shown in Fig. 7. The inlet to the engine is shown at the side, and the

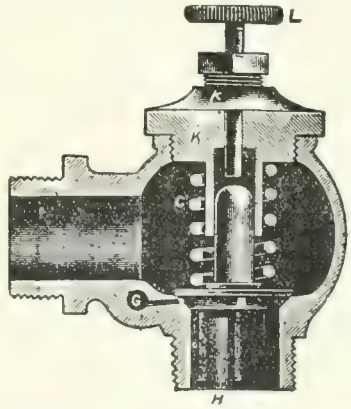


Fig. 7.

main air inlet H to the valve is at the bottom, on which is fixed a non-return valve B under the influence of a spring C, the cap K carries the lift regulating screw I, so that the stroke of the inlet valve can be regulated to suit the best running conditions of the engine. The petrol inlet is shown at G, and it will be observed that on the valve B lifting, the petrol as well as the air inlet is opened. These mixing valves work very well with engines that are always running at full load and speed, but are unsatisfactory, both as regards fuel and general efficiency, when engines have to work at varying speeds, such as are used on marine work for propulsion; it is just as well to mention this valve, as there are thousands of this type in work, and they need a certain amount of understanding, otherwise they are, as will be seen, quite simple and effective; of course, the before-mentioned carburetter is not required when the above type of mixing valve is used.

As regards lubrication, one usually sees a box of tricks called a pressure lubricator, and unless one has had experience with this type of lubricator it appears sometimes strange. Fig. 8 will explain one of these very simple and generally effective lubricators; the oil is filled in through some suitable cap in the top of tank A, a connection through suitable gauze is taken from the exhaust pipe from the engine and taken to the pipe F; this, as will be seen, leads to the top of the chamber A, and consequently the pressure is on the top of the oil, which forces the oil up the pipe E, and after passing through the regulating screws or valves shown at B, the drops find their way through the pipes D, and through the connections G to the engine bearings or cylinders as may be. The real advantage of this type of lubricator will be seen and is that as soon as the engine is stopped, or is reduced in speed, the pressure is automatically reduced in the pipe and the chamber A, and the drops are consequently either reduced or stopped as may be, and generally speaking, once set, this type of lubricator is very reliable and rarely gets out of order. As before mentioned, the economy is reduced if the engine is to run at below the critical speed for which it is designed to give the maximum speed and power, and various

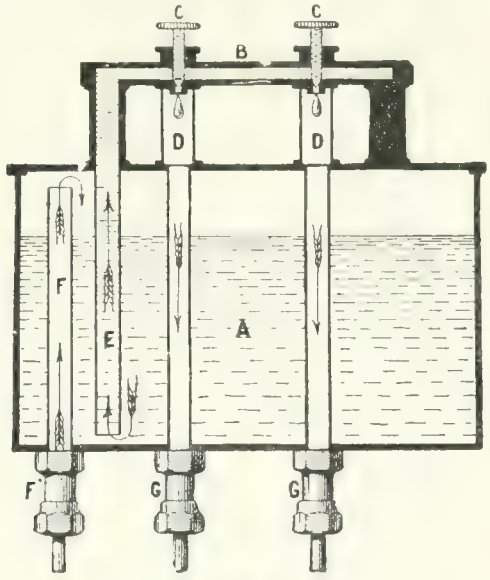


Fig. 8.

methods are to be found for bringing about a variation in the revolution speed of such petrol engines; one way is to put in a small wing valve in the pipe between the carburetter and the engine inlet, but it will be observed that this only cuts off the fuel supply, and does not alter the point of ignition of the fuel in the cylinder, so that as the speed of the engine decreases, a time comes when the spark arrives too early and the engines usually give a kick and stop. The reason for this is very evident to those who study the question, and is this, that an explosive mixture takes a certain time to ignite and burn the fuel, and thus to raise the pressure in the combustion chamber, so that if an engine is designed to run and do its work at, say, 800 r.p.m., the ignition of the compressed mixture will be really arranged for before the end of the second or compression stroke, so that as the time for burning the fuel is different from that of the speed of the piston, owing to the high revolutions of the engine, by the time the piston has arrived at the full compression or end of such stroke, the full pressure will be available for expansion during the next outward or expansion stroke. If the engine is reduced, say, to half speed, the engine will stop for the above reasons, or a great knocking sound called pre-ignition will be evident to those present, which means a great loss of power and is in many cases dangerous, unless the engines are very strongly built to withstand these abnormal pressures, as it will be observed the time taken to ignite and burn the fuel remains constant, but the piston speed has reduced to half.

In the author's opinion no engine should be put to work that does not provide automatic methods by means of some suitable sensitive governor that the advance or retardation of the point of ignition is automatic with that of the speed variation, and this, especially so, in very powerful engines, such as will in the near future be used in marine engineering work, whether for propulsion or auxiliary driving. Fig. 9

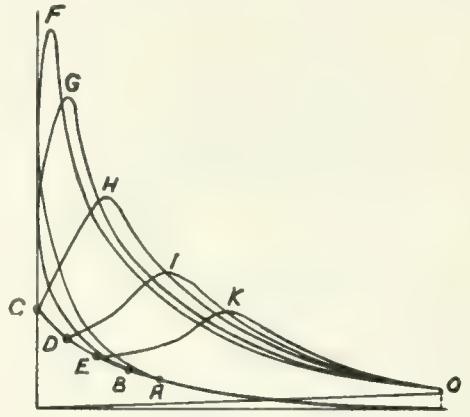


Fig. 9.

is a diagram showing the shape of the pressure and expansion curves for an engine with the point of ignition varied, whilst indicating the engine with a constant mixture; if the ignition is too early then there is likely to be a jar on the engine as explained, and a great part of the power stroke effect is wasted; it is also desirable that the point of maximum pressure should not occur at the dead centre, or otherwise the friction losses will go up considerably, especially at the crank-pin and bearings, and thus cause loss of power by excessive friction. Under the best conditions the point of maximum pressure should be arranged for at the beginning of the out, or expansion or fourth stroke. On reference to Fig. 9, points A, B, C, D, E are taken at the moment of ignition, and the points F, G, H, I, K are those of the maximum pressure. The point A is about one-third stroke ahead of the dead centre, B is about one-fourth ahead, C is on the dead centre, D one-sixteenth after, E is one-seventh after. The curves A F, B G, C H, D I and E K show graphically the relative power effect to be obtained by varying the point of ignition from positive to negative lead or ahead or after the dead centre, and it will be obvious to many that the economy, when the spark is E K, is very low. It, however, goes to point out the importance of having some means to automatically arrange for the alteration of the point of ignition with the variation of speed, if economy is required, etc., and this would also provide means that the engines would be safe on starting up, and at the same time will run at the maximum of fuel efficiency when under work. Further, if the ignition is arranged for the highest pressure to come on just after the turning over dead centre, the expansion will be more complete, and a lower pressure and temperature will have to be dealt with by the exhaust valve when opening, and the maintenance of the engine will be less.

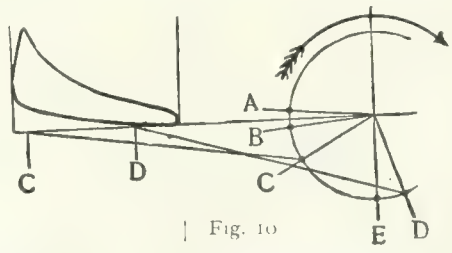


Fig. 10

Fig. 10 shows proper points to arrange for the ignition of small power engines at various speeds and loads. A is the point for starting by hand with safety—it will be impossible to get a kick back if so arranged. B is the point that gives best results for running dead slow, say, about 200 r.p.m., and it will be observed that the point of ignition is just before the piston reaches the end of the compression stroke. C is the point that will give the most economy when the engine is

running with the maximum load at 4000 r.p.m. D is the point of ignition when the engine is run at 1200 r.p.m., with the full load ; and E is the point that gives the best results when the engine is running with a weak mixture, and consequently light load at about 450 r.p.m., to meet the above conditions automatically by means of a speed governor. It will be appreciated that it would involve difficulties that could not be overcome by an ordinary centrifugal governor, and from time to time many ingenious attempts have been suggested to bring about automatic spark timing, and with the consequent economy to be gained, but up to the present time none of these have proved satisfactory, and hand sparking has been relied on, which is, of course, only guess work and not strictly speaking, scientific or accurate, and much will be done in the early future in this important line of investigation.

To thoroughly appreciate the difficulties involved it is necessary to consider all the causes that render the spark variation necessary. As previously stated, as the engine runs faster, the point of ignition has to be advanced to cause it to occur earlier, and when the engine is running very fast it is necessary for the theoretical point of ignition to be even as early as 110 degrees of the crank travel before the dead-centre is reached, before the actual working stroke as is seen in Fig. 10 by diagram. The principal reason for this is the interval of "time" between the first ignition of the gas, and the instant that maximum pressure is reached, as this interval is practically constant with certain mixtures, it is absolutely necessary to advance the point of ignition as the engine increases in revolution speed, if it is desired to keep the point of maximum pressure as shown in the diagram, at the beginning of the working stroke. Two other causes add to this effect—the time lag of the trembler on the induction spark coil, and also the lessened compression attained at the high speeds of the engine, due to the loss of volumetric efficiency caused by the wire-drawing effect of both induction and exhaust valves; these are, however, slightly compensated for by the quicker burning of the richer mixture taken in at the higher engine speeds, caused by the increased suction from extra vacuum in the jet chamber. It is evident that the coil lag is a time-element and that the interval between the completion of the electric circuit and the "break" due to the downward movement of the trembler blade, will be constant for the same coil, and quite independent of the engine speed. This factor is of less importance recently owing to the later design of high-speed tremblers, and is, of course, entirely absent in certain designs of magneto ignition systems. The loss of volumetric efficiency results in more burnt gas being left in the cylinder from the previous charge, and the taking in of a smaller new charge, causing a drop in the compression and consequent slower burning of the gas ; as before stated the degree of compression has a considerable influence on the burning speed of any mixture of given quality. The enrichment of the gas at high engine speeds compensates for this to a certain extent, depending on the efficiency of the valve gear and carburetter, but, of course, this compensation is at the expense of fuel efficiency. It will be quite evident that if the mixture is throttled, thus lowering the compression, it will be necessary to advance the spark to obtain a correct diagram at the same engine speed, and this effect will be intensified, as throttling usually is accompanied by the weakening of mixture ; it comes about, therefore, that any automatic device must not only be able to vary the contact of ignition to compensate for the variation in engine speed, but means must also be provided to vary the throttle to get the suitable quality mixture. The speed of an internal combustion may be altered by variation in the ignition point of contact, but is a very wasteful method, as sometimes xhausting takes place before complete ignition, to the detriment of the exhaust valves.

Important points in connection with valves and their setting have to be studied before the engine running at high revolution speed is economical. The setting of valves is one for the engineer to note, as on their satisfactory working rests efficiency. It is evident that the valves, especially in the multi-cylinder type, must open and close precisely at the proper moment, otherwise uneven working and waste of power will be the result. Fig. 11 shows one setting of the induction and exhaust valves of high-speed four-cycle engines, but every maker has his own way of assuming the best system of valve setting to suit his particular design of engine, this being found by the trial and error method. These comments will serve at least to draw attention to a vital point in high-speed internal combustion engines working with atmospheric pressure on carburetters, etc.

On reference to Fig. 7 in part I. of this paper, 1 and 2 show the dead centres at either end of the stroke. It will be seen that the exhaust valve lifts as marked at B, cutting short the expansion at this point ; 3 shows the position of the crank on the working stroke when this occurs. It will be observed that the valves lift when the crank has arrived at 35 to 40 degrees from the end of the working stroke ; an early opening of position 4 shows when the exhaust valve closes. It will be seen that the valve closes about 5 to 10 degrees after the crank has passed the dead centre and is already on the induction stroke, remaining open, say, during 220 degrees of the crank shaft revolution. Position 5 shows the point where the induction valve opens about one degree after the exhaust valve is closed ; 6 shows that the induction valve has remained open during the remaining part of the induction stroke and also that it does not close until the crank has arrived at, say, 20 degrees of the compression stroke. To those who are used to the setting of valves on the ordinary

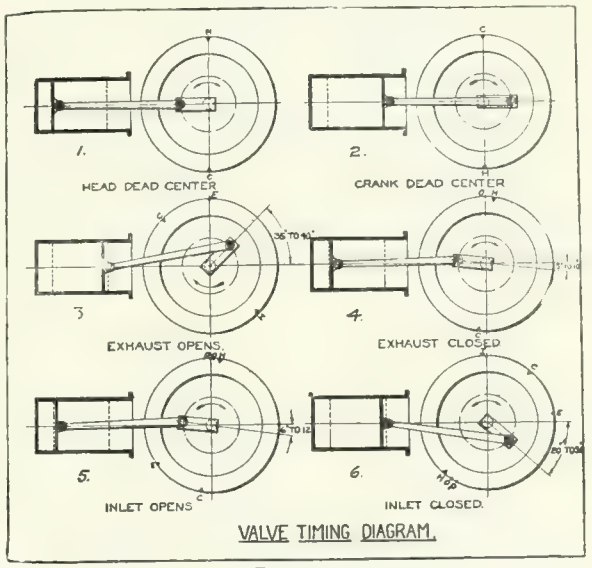


Fig. 11.

slow revolution gas engine this timing for the valves will possibly be new and is brought about entirely by the elements of time and speed. The valve opens early (see 3 and 4) to allow the pressure to be high enough for the burnt gases to escape quickly to the expansion box at first part of the exhaust stroke ; and for the valve to remain open past the dead centre to part of the induction stroke—the reason of this is that in all elements, such as air or gas, at high velocity there is a certain amount of momentum, and it has been proved that by leaving the exhaust valve open past the top end of the stroke more of the burnt gases are allowed to escape from the cylinder, as they are still above the pressure due to the back pressure in the exhaust or expansion box, also the atmosphere. The amount of valve opening depends to a great extent on the cylinder diameter and stroke, valve area, etc.

Positions 5 and 6 refer to the induction stroke, and the valve does not open until the crank is 6 degs. past the top centre, the reason being that the exhaust is open till then ; the induction valve now draws in its charge by means of the mixer. The velocity of the piston soon raises that of the incoming charge until a good vacuum arises owing to the limitation of the area of the induction pipes, etc., the high speed brings the piston at the end of this stroke, with pressure below that of the atmosphere, and the charge is wire-drawn ; the valve is thus left open for a longer period, that the incoming gases may have time to get as good a mixture in the cylinder as possible. It will be observed in Fig. 4 that the compression pressure is very low at this end of the compression stroke. It will thus be evident that it is most important to have a thorough knowledge of valve setting, and these few remarks may lead to further investigation. In the designs now in

hand of large internal combustion engines combining those with electrical power transmission for marine propulsion, the points indicated will be attended to by means of electrical apparatus, the valves being arranged to lift and remain open, the period also will be electrically controlled automatically, and probably such is the only method that will prove suitable.

Where the engines are not required to reverse, as when using electrical, hydraulic or mechanical gear, or in the application of the "Paragon" propeller previously referred to, an internal combustion engine embodying good points as regards efficient working, is the design known as the off-setting of the cylinders in the direction of the revolution of the engine, where the cylinder is placed, say, one-third of the diameter out of the centre of the shaft. On automobiles and other machines it has been found that engines so constructed work with greater smoothness, and higher mechanical efficiency than those in which the centre of the cylinder is exactly in line with the crank centre, this design of engine is being successfully employed in a vessel now being built, fitted with suction gas plant and will, no doubt, prove efficient for quiet working and cause less strain on the hull. By reference to Fig. 7, part I., the point of highest pressure is when the piston is just over the top dead-centre; the side pressure is then between the piston trunk and the cylinder walls, but, as the crank goes round, the angle is increased and although the pressure per square inch on the piston head is reducing, by reason of the expansion, it has been proved that a great amount of energy is lost in the pressure causing extra friction between the piston and the cylinder walls. Many attempts have been made to reduce this, employing extra crank levers and other means, but the design stated appears to be the best, because of its simplicity, easy arrangement and reduction in working parts, and there is no question that in the designs of the large engines that will be used, in engines of large power this will be embodied, if mechanical and other efficiencies are desired. If, however, such engines are to be made direct-coupled and reversible, this ideal method of getting high mechanical efficiency will have to be sacrificed, and at the same time it must be remembered that this high side pressure will in the end result in the cylinder wearing oval, consequently engines constructed on the off-setting principles will have longer life as regards liners, etc.

In designing marine internal combustion main or auxiliary engines dealing with large power, the question of balance is of vital importance, especially as such engines do not have a concrete base to work on. I do not refer to a balance obtained in the workshops by balancing the pistons and crank-shafts by weights, etc., but there is an out-of-balance brought about by the effect of the explosion or high pressure during the working stroke, and although an engine may be found to be perfect under ideal condition as regards balance, when being turned round by some external means, immediately it is working on its own power it may turn out that it runs greatly out of true balance; thus great vibration may be set up, and in order that the balance shall be as nearly as possible equal, and also that the maximum amount of actual work shall be got from the engine per unit of fuel burnt, it is essential in multi-cylinder engines that the points of ignition shall be identical in each of the cylinders in relation to the position of the crank. The timing of the valve gear should also be accurately set equal in each cylinder, otherwise the amount and quality of the mixture will vary in each cylinder, and the indicator cards taken from any of the cylinders will have different shapes; the engine will then be working under wasteful, noisy, vibratory conditions. Attempts have been made to make the synchronous working of such engines reliable, but it is a difficult matter, and in some designs of marine engines separate ignition devices have been tried on each of the cylinders, but in the writer's opinion the only way in which this may be secured is by means of an accurately divided and reliable distributor directing the current for ignition to each cylinder at the proper and right moment, when also the control of advancing and retarding the point of ignition can be carried out with greater precision than is possible, and at the same time quicker than is the case where the ignition is separate for each cylinder, as in the case where a hot tube or hot cylinder end is relied on, where the difference in the temperature of either tube or cylinder end will cause an unequal time of ignition for mixtures of equal quality.

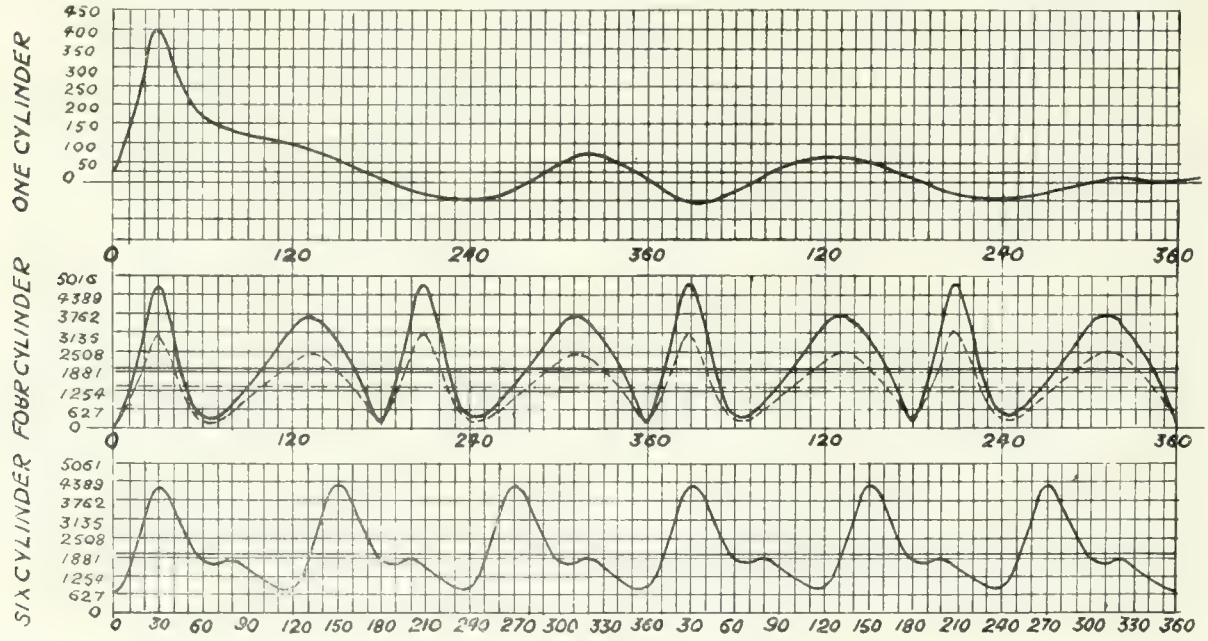


Fig. 12.

The question of equal turning moment is another important one, and as regards four-cycle engines there is no question that the six-cylinder engine gives a very satisfactory job; it gives absolutely smooth running owing to its continuous turning moment, which at the same time reduces the cost of upkeep, and this is applicable to propulsion as regards propeller shafts, etc. Fig. 12 shows the torque diagrams and pressure curves for single, four and six-cylinder engines, and emphasizes this point. The variation of pressure in the cylinder is a matter for first consideration, and for the purpose of discovering what actually takes place a standard six-cylinder Napier engine was used under the tests from which this curve is drawn, and by way of manograph indicator diagrams and pressure recorders.

To be continued.

The author wishes to express his acknowledgment of the assistance he has received in the preparation of this paper from the following:—"The Motor," "The Motor Boat," "Engineering News," "Self-Propelled Vehicles," by Mr. J. E. Homans, and Mr. F. S. Edge's paper read before the Royal Automobile Club, The Diesel Engine Co., The M.A.N. Diesel Engines, The Griffin Engine Co. and The Lamplough Engine Co.

ELECTRICALLY OPERATED TACHOMETERS AND TACHOGRAPHS FOR DISTANCE SPEED RECORDING.

TACHOMETERS and Tachographs are usually operated by centrifugal force, upon the same principle as the pendulum governor. They may be connected in many different ways to the shaft, the speed of which they are intended to record, but in any case they must be fixed in close proximity to the same. It may often, however, be of great advantage to be able to read the recorder some considerable distance from the machinery, notably in the case of steamships, large power stations, etc., and with a view to making this possible, the electrically operated tachometer has been introduced. The general description given hereafter may therefore prove interesting.

The current is generated by a small d.c. dynamo as shown in Fig. 1, which may either be belt-driven or direct coupled to the shaft to be tested—the latter method being strongly recommended if changes in direction are sudden or frequent. The dynamo is absolutely damp and water-proof and can consequently be run under all conditions—it may be mentioned here that before leaving the works of Dr. Th. Horn, where these instruments are manufactured, the dynamo is tested under water. The dynamo is constructed with permanent magnets and the voltage between its terminals will be proportional to the speed. The segments of the commutator are made of very hard material to prevent all wear by the brushes, and the current being so very low (not even 0·1 ampère) there will be no sparking. The dynamo is constructed with the greatest care throughout and its design is very superior, Dr. Horn having had a wide and long experience of them, and we are informed that instruments of this type have been in use for more than five years without the commutator showing the slightest sign of wear, or there being any diminution whatever in the power of the magnets. Spare brushes are supplied with the instruments. Beyond cleaning the collector two or three times a month, the instruments require little or no attention.

Connected to the dynamo by ordinary copper wire, the recording instrument may be placed at a convenient distance up to 100 yards or even more. It may take the form of a counter, tachometer or tachograph or any combination of them, and the two latter instruments may be arranged to show both the speed and direction of the running machinery.

Fig. 2 shows a tachograph electrically operated in the manner described which in this way records speed with an exactness of half per cent. of the maximum output. The tachograph may be graduated in revolutions per minute with zero in the centre, if required, and with any desired range. A good voltmeter, Deprez d'Arsonval or Weston type, graduated in r.p.m., would be the best tachometer possible. Another great advantage to be obtained by the use of the electrically operated tachometers and tachographs is that five or six recording instruments may be connected to the same shaft by means of one dynamo only. This arrangement enables the speed to be read at several places at the same time.

Fig. 3 shows a combined tachometer and counter, specially constructed for use on board ships, and Fig. 4 depicts an arrangement as frequently used on ships, with two tachometers, by which the speed may be read on the bridge as well as in the engine room. In this connection it is of interest to record that the

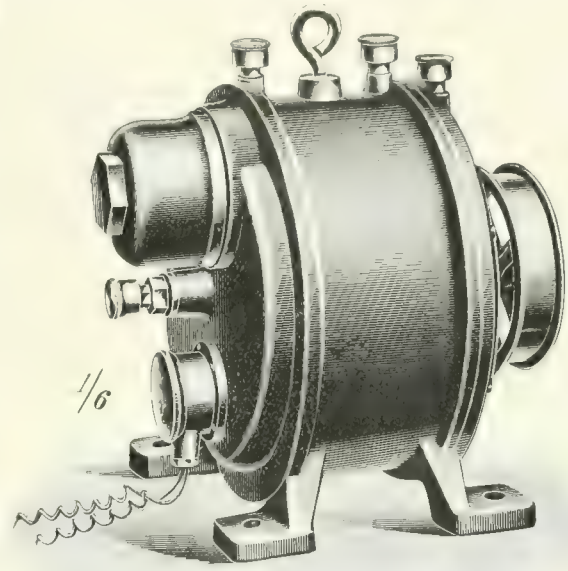


Fig. 1

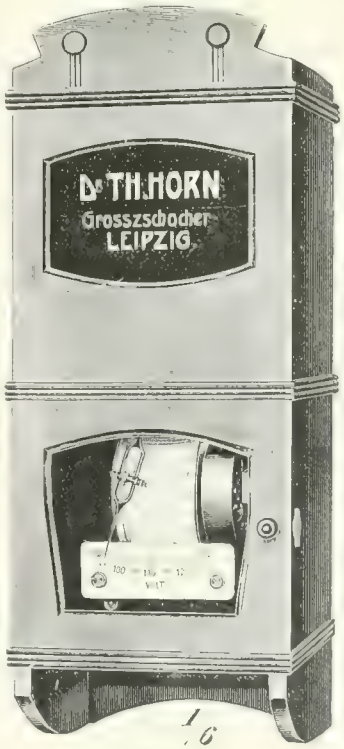


Fig. 2

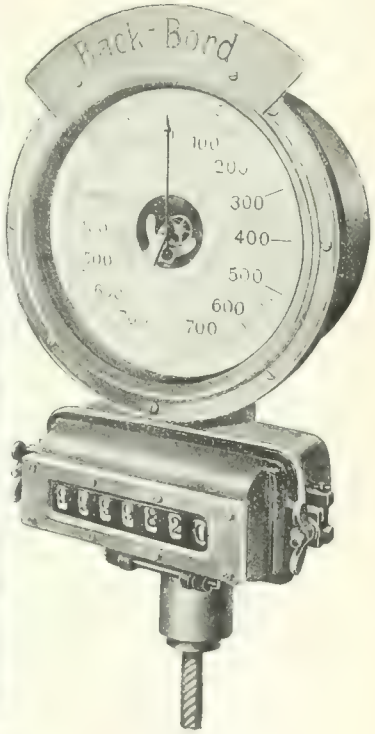


Fig. 3

instruments are used on board some sixty new turbo-driven torpedo-boats of the German Navy, and a number of the modern German men-of-war. The instruments have also been adopted by the Brazilian, Argentinian and Turkish Navies and by

the Belgian Government for their Channel steamers. Other steamers have been fitted, and everywhere the instruments work to the satisfaction of the users. It will readily be understood that by the adoption of this instrument, the chief officer on board will know

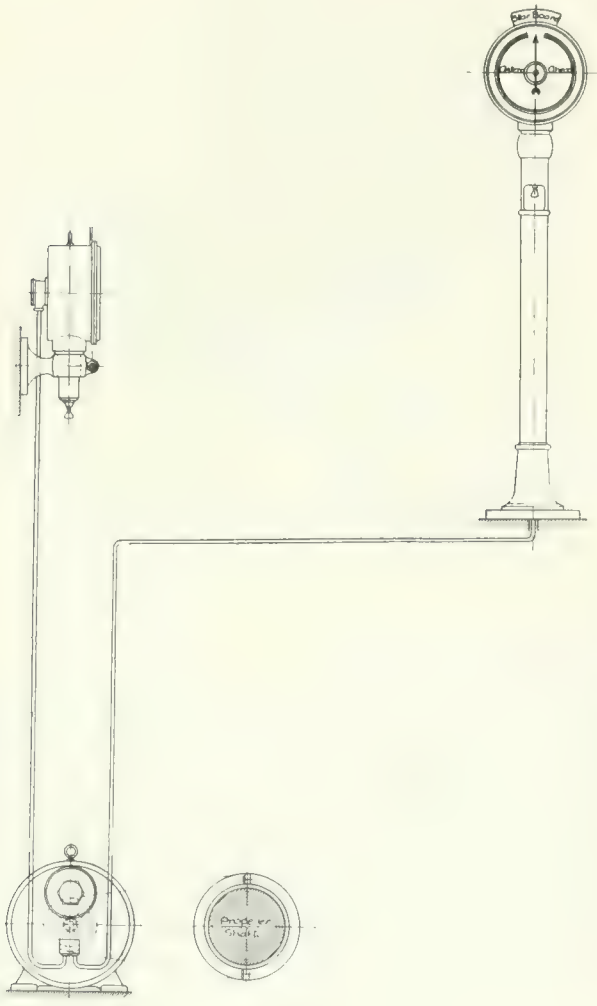


Fig. 4

more about the work of his ship, as he will be in a position to read the exact speed of the tail shaft at any time. We may mention that one of these instruments was exhibited at the Engineering and Machinery Exhibition in Manchester, and attracted the interest of many engineers and marine superintendents. Dr. Horn's agents in the United Kingdom are Messrs. Jens Orten-Böving & Co., of 9½, Union Court, Old Broad Street, London, E.C.

LIVERPOOL ENGINEERING SOCIETY.—The third ordinary meeting of the session was held on November 30th, at the Royal Institution, Colquitt Street, Liverpool, when Mr. J. B. C. Kershaw, F.I.C., read a paper on "The Control of Fuel Supplies." The fourth ordinary meeting will be held on the 14th December, when Dr. R. Lessing will read his paper entitled "Refractory Materials." The annual dinner will be held on Thursday, January 19th, 1911. The Council have decided to give a Student's Prize for the best paper on an engineering subject submitted during the session, by a duly qualified student of the Society.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our Own Correspondent.)

Portsmouth Dockyard.

WORK on the battleship *Orion* is proceeding rapidly. Nearly all the side armour is in position, the boilers are on board, and the turbines are being placed in the ship. The Marchioness of Winchester, who named the vessel when she was launched in August, is commemorating the event by the presentation of a silver bowl, which will be handed over to the captain and officers of the ship when she is commissioned about a year hence. It is uncertain whether the laying down of our new battleship will be expedited. There is still a good deal of work to be done at the building slip, and the keel plates may possibly not be laid down until January, instead of in December as anticipated. All that appears to be known is that the vessel will be a battleship of about 28,000 tons displacement. The battleship *Neptune* is carrying out her trials and is expected to be ready for commissioning early in January. It is generally understood that she is to relieve the *Dreadnought* as flagship of the First Division of the Home Fleet. The battleship *Hindustan*, of the Second Division of the Home Fleet, has arrived for her annual refit, and several other large vessels are due for extensive overhauls, including the *Dreadnought*, which it is expected will be paid off and placed in dockyard hands on being relieved by the *Neptune*. The cruiser *Drake* is also to come in for a refit, and another of the *King Edward* class is to be taken in hand when the *Hindustan's* refit is completed. The refit of the cruiser *Good Hope* is finished, and it is reported that she may be sent to Australia to relieve the *Powerful* as flagship. The surveying vessel *Research* was reduced to winter complement on November 2nd. She has been engaged for some time past endeavouring to locate the rocky obstruction which the battleship *Hannibal* fouled at Plymouth early this year, but the search was not successful. A new patent suction hopper dredge, fitted with a screw-cutting apparatus for dredging in stiff clay, which has been specially built for the Admiralty by Messrs. Simons & Co., of Renfrew, arrived in the early part of November. The new dredger, which is the first of the type to be used by the Admiralty, will dredge to a depth of 65 feet, and will be first employed in dredging the deeper portion of the berth for the new floating dock which is to be placed in Fountain Lake.

Devonport Dockyard.

The cruiser *Indefatigable*, having had her guns and torpedo equipment and electrical fittings tested, was undocked on November 5th and prepared for her official steam and other trials, which she is now carrying out, and which it is anticipated will be completed before Christmas. Official instructions have been received that she is to be ready for commissioning by February 23rd, which will be two years from the time she was laid down. The progress of the cruiser *Lion* continues to be very satisfactory. The boiler-rooms are nearly completed, and the four 13·5-inch barbettes are in hand. The teak backing of the side armour has practically all been placed in position and is being got ready for receiving the armour, which will be in three thicknesses. The material for our new battleship continues to accumulate, and everything is ready so as to make a start immediately the order is given. The plans arrived here on November 16th. There are many rumours afloat, but there are no reliable indications that the vessel will be laid down before January, as stated last month. The refit of the cruiser *Highflyer*, which has been of a very extensive nature, has been completed, and the vessel is to be commissioned for service in the Nore Division of the Home Fleet on December 13th. The *Emerald*, formerly the ironclad *Black Prince*, has been moved alongside No. 2 Jetty so as to enable the work of adapting her for service as a training tender to the *Impregnable* to be taken in hand. This old vessel served for some years in the Channel Fleet as flagship, being in her day quite a smart vessel. Eleven years ago she was commissioned at this port for service at Queenstown as a training-ship for boys, her name being changed to *Emerald* in 1904.

When she ceased to act as a training-ship she continued at Queenstown as a receiving ship and flagship of the Admiral on the coast of Ireland, and in July last she was relieved by the battleship *Hood*. Several destroyers are in hand, including the *Moy*, in which it was found necessary to replace the funnels. The *Ranger*, of the Sixth Destroyer Flotilla, went on shore off Selsea Bill during thick weather on November 5th, and was towed into Portsmouth Harbour with her propellers damaged, being brought on here five days later. A sad affair happened when the torpedo-gunboat *Gossamer* was in Weymouth Bay on the evening of November 6th, a whaler belonging to the vessel capsizing while making for Portland. The boat was struck by a squall, her five occupants being thrown into the sea. A steam pinnace was near and succeeded in picking up three of the men, but the other two—Staff-Surgeon Watt and Gunner Carter—were drowned. The first inspection of the *Indus*, the boy artificers' training establishment, was made on November 4th by Admiral Sir Wilmot Fawkes, the commander-in-chief, who was accompanied by Flag-Captain Halsey and Engineer Rear-Admiral Elbrow. The party was received by Commander Henslowe, the commanding officer. Accompanied by the ships' officers, the Admiral made a tour of the five vessels forming the establishment, and saw the boys, of whom there are over three hundred, at work. On November 9th, we had a visit from Rear-Admiral Briggs, who is to succeed Rear-Admiral Sir John Jellicoe as Controller of the Navy. In company with Mr. Marshall, the Director of Dockyards, and Rear-Admiral Stokes, the Admiral-Superintendent, Admiral Briggs made a tour of the establishment.

Chatham Dockyard.

The number of vessels undergoing refit has been reduced during the month by the departure of the flagship *Shannon* for Portland, where, on November 29th, Rear-Admiral Sir George Warrender hoisted his flag in succession to Rear-Admiral Lowry, who now commands the Second Cruiser Squadron. The *Shannon*, it may be recalled, was the last cruiser built at Chatham. She was the longest cruiser laid down here, and it was found necessary to lengthen No. 7 slip for her. The new cruiser to be commenced immediately will, it is understood, be longer than the *Shannon*, but she will be constructed in the open. The battleship *Victorious* has been passed out of dockyard hands after undergoing her annual refit, and has proceeded to Sheerness to coal and complete preparations for taking part in the cruise of the Third Division of the Home Fleet. The destroyers *Nubian*, *Saracen* and *Amazon* have completed their refits and rejoined the First Flotilla. Three vessels of the flotilla are still in hand—the *Cossack*, *Afridi* and *Maori*—while two other destroyers, the *Panther* and *Usk*, are in dockyard hands. The larger vessels under repair include the battleship *Irresistible* and the cruisers *Cressy* and *Euryalus*. The *Triton* and *Hearty* have completed their season's surveying work and have come in to be berthed in the steam basin for the winter months. For the first season the vessels have been employed on this portion of the East Coast on surveying work. The *Hearty* for a time was assisted by four mine-layers of the Home Fleet, which were engaged in making tidal observations in the North Sea. Part of the work of the *Triton* included tidal observations in the Medway and survey work in the vicinity of the mouth of the Thames. An interesting speech was made at the Mayor of Chatham's luncheon on November 9th by Rear-Admiral Ommanney, superintendent of the yard. The Admiral said he was glad to assure the company of the prosperity of the establishment, the wages the previous week having amounted to £15,000, the highest sum ever reached in the yard. There was, he said, no reason to apprehend discharges of workmen, as a full programme of work had been provided. The Dockyard Engineering Association is starting the winter session most favourably. The Admiral-Superintendent has again accepted the office of President and Engineer Rear-Admiral Rudd that of Vice-President. The syllabus of lectures is varied. Engineer-Commander C. Baldwin will deal with mechanical flight, the working of different types of boilers, petrol, oil and gas engines, and marine propulsion, while Engineer-Commander J. Liversidge will lecture on reciprocating and different types of turbine engines. Mr. J. Williams, foreman in the engineering department, is also to lecture during the season, which, it is anticipated, will be a most successful one.

Sheerness Dockyard.

We have plenty of refitting work in hand just now, mainly in the shape of torpedo-boats, of which there are a dozen under repair. While a division of the Nore Torpedo-Boat Flotilla was exercising at the mouth of the Thames at the end of October, a collision took place between No. 072 and No. 066. The damage to the latter vessel extended from the deck to within three feet of the keel plate, the hole being four feet wide just below the water-line. She has had the damaged plates replaced and is nearly ready to rejoin the flotilla. The damage to No. 072 is more extensive. A new stem will be required, and the bows on either side will have to be reconstructed for several feet. Two of the new turbine boats, Nos. 21 and 22, have come down from Chatham to be refitted. The *Welland*, which underwent a thorough refit, has been commissioned for service in the Nore Destroyer Flotilla, which now consists of ten vessels of the "River" type and twenty-four of the latest type of torpedo-boats. The *Rother* will join the flotilla in December on being relieved in the Second Flotilla by the *Nautilus*, unless the damage received by that boat recently whilst running a trial in the Thames should retard her completion. The *Conflict* and Torpedo-Boats Nos. 31 and 32 have completed their refits and have rejoined the Third and Sixth Flotillas. The *Lively* and *Sprightly*, which were recently relieved in the Nore Flotilla by "River" boats, have been taken in hand to be refitted before going to Devonport to join the Fifth Flotilla. There is to be a rearrangement of the moorings for the First Destroyer Flotilla at Harwich, and about forty additional moorings are to be laid there for destroyers and their attached ships. Captain Sir Robert Arbuthnot, Bart., will at the end of November hoist his broad pennant in the *Boadicea* as Commodore of the First Flotilla in succession to Captain Charlton. The battleship *Caesar* returned at the end of October with a battle practice target from Lamlash. A curious accident happened at Sennen Cove, when the target got adrift and went ashore. An attempt was made to drag it into deep water by means of a wire hawser attached to a capstan on shore, but the strain was so great that two of the capstan bars broke and the capstan took charge, eight men being injured. The crew of the wrecked cruiser *Bedford* have arrived from Hong Kong with the boats and the other stores salved from the vessel. The court-martial was held here under the presidency of Vice-Admiral Sir George Neville. Courts-martial of such importance are a rare occurrence at this port. The Chilian cruiser *Blanco Encalada* arrived on November 5th, and having coaled and shipped ammunition sent from Elswick, proceeded on the 15th to Bremen to embark the body of the late President Montt for conveyance to Chili for interment.

Pembroke Dockyard.

Our last vessel to be completed, the cruiser *Blanche*, was commissioned on November 10th by Commander Marston for service with the First Destroyer Flotilla of the Home Fleet, in relief of the scout *Pathfinder*. The *Blanche* has taken a year and two months to build and complete for service, having been laid down on April 12th, 1909, and she is the third vessel of the class to be completed. The first, the *Boadicea*, is the vessel of the Commodore of the First Destroyer Flotilla, while the *Bellona* is the ship of the commanding officer of the Second Flotilla. Externally there is very little difference between the three vessels, with the exception that the *Blanche* has one mast instead of two, but there is a difference in the machinery, the cruising turbine which was fitted in the two first ships having been dispensed with in the case of the *Blanche*. It is interesting to compare the cost of the three vessels, which in the case of the *Boadicea* was £330,631. The *Bellona* cost £283,038, while the estimated cost of the *Blanche* is put down at £288,016. Rapid progress is being made with the *Blonde*, and by the end of November all her funnels will probably be in position. Day and night shifts are being worked in the engine-rooms, it being the intention to get the turbines ready for steaming before the end of December. Messrs. Cammell, Laird & Co. are sending all the parts of the machinery here in a state as complete as possible, the boilers, for instance, arriving with the fire-places bricked. With regard to our other vessel, the *Active*, the frames at the bow and stern have been erected and the outer bottom plating will probably be completed by the middle of December, so as to permit of boring opera-

tions being commenced by Messrs. Hawthorn, Leslie & Co. The date of the launch has not yet been fixed, but it will no doubt take place during February. In that month it will be necessary to lay down our next vessel, the *Amphion*, on which £10,200 is to be expended in labour before the end of March. The contour plates of the *Amphion*, which form the upward continuation of the stern post, have been prepared and put in place. The amount allowed for material for the vessel during the present financial year is £12,150. The destroyer *Cheerful* has arrived to undergo a thorough refit, which is to include the retubing of her boilers and the renovation of the propelling and other machinery. The *Locust* and *Cynthia*, of the Devonport Destroyer Flotilla, have also been sent here for their annual refits, and this has necessitated small entries of labourers and fitters. The destroyer *Foyle*, which is undergoing a thorough refit, and the *Locust* have been dry-docked, being placed side by side in the dock on special tiers of blocks, which were laid for the torpedo-boats. It was the first occasion on which two destroyers were docked in this manner at Pembroke. The destroyer *Avon* has been completed and is ready for her commissioning trial.

INSTITUTE OF MARINE ENGINEERS.

Presidential Address.

AT the Institute of Marine Engineers, on October 31st, Sir David Gill, K.C.B., etc., gave his Presidential Address, dealing principally with the subject of "Accuracy of Measurement."

In the course of his address, which was listened to with rapt attention, Sir David said, not only was it the first instinct of the scientific mind to measure, and to measure accurately, but the necessity for doing so was impressed upon him by the fact that the value of an observation increased as the square of its accuracy, that is to say, inversely as the square of its probable error. It was only within recent years that the tools and methods of astronomers had been so improved that the determination of the distances of fixed stars became a problem capable of practical solution, and to the mechanician, the optician and the engineer, the astronomer was largely indebted for the success which, in recent years, had crowned his efforts in that line of research. If accuracy was necessary to the astronomer, it was no less necessary to the engineer, though perhaps in a different degree. Nowadays we were beginning to realize, especially in engineering practice, the necessity for absolute standards. Probably every standard, of whatever substance or metal it might be composed, was subject to change of length, by the slow rearrangement of its constituent molecules in course of time. If we were to have a standard which would be constant for all time, we must have recourse to a natural standard, and incomparably the best of these that had ever yet been suggested, was that of Clerk Maxwell, *viz.*, the wave-length of some well-defined monochromatic ray of light. The red line of the spectrum of cadmium vapour was, so far as we knew, the best-defined spectrum line which could be readily observed, and for that reason it had been selected for comparison with the metre.

Of our British standards, in the highest scientific sense, perhaps the less said the better—no man of science would, he thought, refer to them seriously. From the international point of view there could be no question that universal standards for the whole world would be an obvious simplification and its advantages inestimably great, but he did not think it was a practical proposition to suggest that the world should accept British standards when all the world, except Britain and America, had adopted the metric system. It was high time that such loose terms as "tight fit," "smooth fit" and "easy fit" were abolished. If constructors were to adopt the system of expressing on working plans the required dimensions in decimals—denoting the requisite accuracy by the number of decimals quoted, the whole matter would be simplified. It was certainly desirable that this, or some other conventional mode of stating the accuracy on working drawings, should be arrived at by common consent. The work might then be given to any number of different workshops and sets of men, and it could all be assembled and put together without difficulty. Perhaps this system had not been sufficiently carried out in practice because of the difficulty of comparing gauges with graded standards, or even of obtaining these standards of the requisite accuracy. That difficulty had now been overcome for our workshops by the establishment of the National Physical Laboratory at Teddington. This admirable institution, under its very able director, Dr. Glazebrook, was now prepared to test, or determine the error, of any gauge, of any kind required in the practice of the arts and sciences.

Sir David afterwards commented upon the work of the Institute, referring to the value of the papers and discussions, the monthly issues of the transactions, reading room and library, concerts and other social functions. He was glad to see that the steady increase in the membership was being maintained, and referred to the excellent work done by the hon. secretary.

INSTITUTION OF NAVAL ARCHITECTS.—The ordinary dates for the next Annual Meetings of the Institution will fall on Wednesday, 5th April, 1911, and the two following days. The Council will be pleased to consider offers of papers on subjects relating to Naval Architecture or Marine Engineering. Such offers (or suggestions for papers on matters of interest to the Institution) should, if possible, be sent in by the close of the year. The dates for the Jubilee Meetings of the Institution have been provisionally fixed for Tuesday, July 4th, 1911, and the following days, and it is intended that the Programme of the Meetings shall be on similar lines to that which had been prepared for the present year.

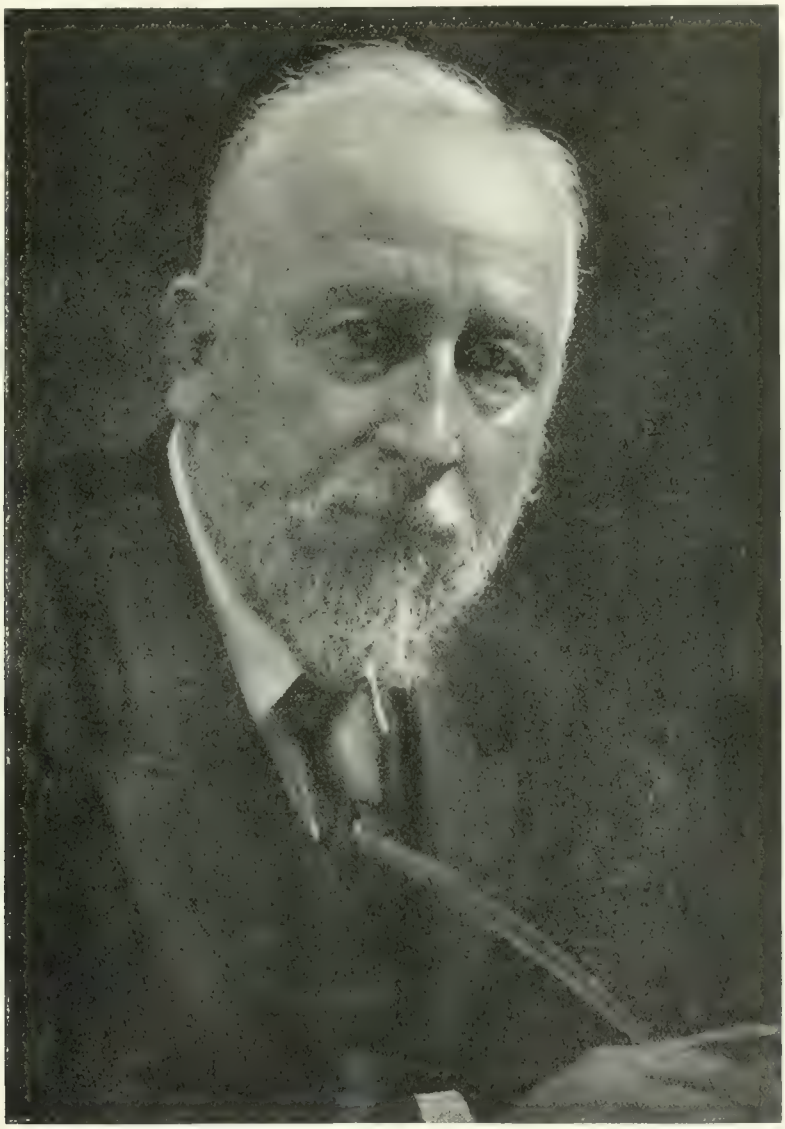
HARRISON STEERING GEAR.—Messrs. Alex. Turnbull & Co., Ltd., of St. Mungo Works, Bishopbriggs, Glasgow, wish to make it known that they are still making Harrison Steering Gears, which, for many years past, have had the highest reputation amongst shipowners. They are also improving their designs and facilities for manufacture, so that the gears now made are in many ways superior to the Harrison Gears made in former years. Messrs. Turnbull wish shipowners and shipbuilders to note the above, as they have recently heard that a report is being put round (doubtless by interested competitors) that Messrs. Turnbull are not now making the Harrison Gears. This is wholly untrue. Messrs. Turnbull have in hand at present quite a number of Harrison Steering Gears for steamers being built for leading shipping lines.

THE SCHMIDT SYSTEM OF SUPERHEATING.—Our readers will be interested to know that the total horse-power installed on the Schmidt system and on order is 301,000. The number of ships fitted and orders received during 1910 amount to ninety-seven. Fifteen ships have been fitted with the Schmidt system by the Oldenburg-Portuguese Company; fifteen by the Argo Steamship Company; thirteen by the Deutsche Levante Line; six by the Hansa Line; and eight by Robert Sloman, Jr. Among other Companies using the Schmidt Superheater are:—The Hamburg-Bremer African Line; Chargeurs Réunis; Hamburg-American Line; Austrian Lloyd; and Norddeutscher Lloyd. The German naval authorities have had the system fitted in the *Dresden*, *Mainz*, *Koln* and *Kolberg*. The total number of vessels fitted or being fitted to date is 321, which shows the great advance being made in the adoption of superheated steam on the Schmidt system.

SIR DAVID GILL, K.C.B., F.R.S., D.Sc.

SIR DAVID GILL, K.C.B., F.R.S., D.Sc., whose portrait we have pleasure in reproducing by courtesy of the *Dollar Magazine*, is an astronomer, highly distinguished for his attainments and researches in that branch of science, who, in virtue of his known sympathy with things engineering and mechanical, was elected President of the Institute of Marine Engineers for the session 1910-1911. His Presidential Address, delivered on October 31st and reported in this issue, proves the wisdom of the Council of the Institute in nominating him for the position, as it will form a valuable addition to its Transactions.

He was born at Blairythan, in Aberdeenshire, in 1843, educated at Dollar Academy, Clackmannanshire, and at Marischal College in the "Granite City." Like many other distinguished Scotsmen, his success was achieved in countries far from his native land. After studying astronomy at a private observatory at Aberdeen for five years, he organized Lord Lindsay's expedition of 1873-6 to the Mauritius for the purpose of observing the transit of Venus in approximating the distance to the sun. Eight years later he again organized expeditions for this purpose in South Africa. This country was the scene of his labour for a period of twenty-nine years, from 1879 to 1907, during which time he held the position of H.M.'s Astronomer at the Cape of Good Hope. He was successful in his observations of the distances of various stars and planets, and, in addition to his astronomical work pure and simple, gained distinction in survey work necessitating some degree of civil and mechanical engineering skill. In 1877 he measured the base line for the geodetic survey of Egypt, carried out the geodetic



Sir David Gill, K.C.B., F.R.S., D.Sc.,
President of the Institute of Marine Engineers.

survey of Natal and Cape Colony during the years 1885 to 1896, and in the following year organized the geodetic survey of Rhodesia. He was largely responsible for the introduction of the use of photography into astronomical science, and in 1882 photographed the great comet of that year.

His publications on subjects connected with astronomy are numerous and valuable, and the honours he has gained in various countries stamp him as one of our most brilliant living scientists. He received from the Khedive the Third Order of the Medjidie for his work in Egypt, the Gold Medal of the Royal Astronomical Society and the Valz Prize of the Institute of France for his observations of Mars in 1882, the Gold Medal of the National Academy of Science, Washington, in 1900, the Gold Medal of the Astronomical Society of the Pacific, and the Royal Medal of the Royal Society, London, in 1903. He is a correspondent of the Institute of France and member of the Academies of Science of Berlin, Rome, St. Petersburg, Amsterdam, Washington, New York. He was recently appointed Foreign Knight of the German Order of Merit for Science and Art and is an officer of the Legion d'Honneur; is a past President of the British Association, and is now President of the Royal Astronomical Society.

In the course of his speech at the annual dinner of the Institute the Astronomer Royal, Professor Dyson, attributed Sir David's brilliant success as an astronomer largely to his mechanical instinct and his grasp of engineering conditions.

In addition to the admiration and respect with which Sir David was regarded for his scientific attainments, he was esteemed during his long residence at the Cape of Good Hope for his geniality and social qualities, and that esteem will be shared by all who were privileged to be present on the occasion of his Presidential Address on October 31st and at the annual dinner of the Institute under his chairmanship.

REFRIGERATED CARGOES.—The alterations and improvements which have been made at the Royal Albert Docks to facilitate the discharging of refrigerated cargoes from the "Highland" steamers were recently completed and operations are now in full swing. The amount of produce exported from Argentine has reached large proportions, about 92,000 quarters of frozen and chilled beef in the course of a week, about 72,000 carcases of mutton and 7,500 carcases of lamb. The totals for the present year will probably reach quite 3½ million quarters of beef, three million carcases of mutton and about 400,000 carcases of lamb. More than half of these come to London. The chilled meat appears to find greater favour than the frozen, and with this the advantage rests with the shorter voyage range, but successful attempts have been made to carry chilled meat over the longer voyages from New Zealand.

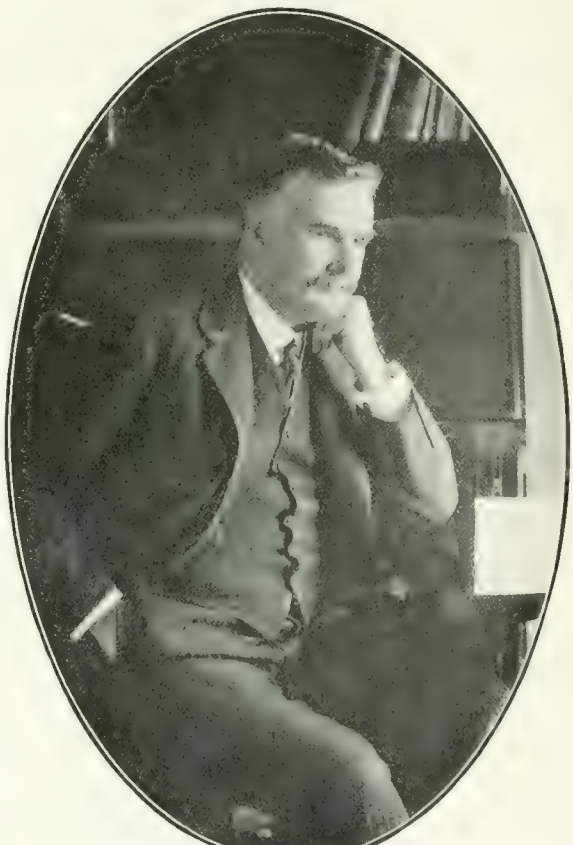
THORN'S SCHOOL OF MARINE ENGINEERING.—At the examination held for Extra First Class Engineers in October, the following candidate was successful, Mr. J. Aitken, Jr., at Leith. He was prepared by Messrs. Thorn's highly-successful system of tuition, and passed the first time up, making 191 successes in this grade from the establishment of Messrs. W. H. Thorn & Son, 5, Waterville Terrace, North Shields.

MESSRS. FRANK & SONS, of South Shields, the well-known specialists in marine and engineering photography, supplied the photograph of the launch of the *Olympic* illustrated at the head of the supplement to our November issue.

MESSRS. WM. SIMONS & CO., LTD., Renfrew, have been awarded "Grand Prix" for their exhibit of dredge plant at the Railway and Transports Exhibition in Buenos Aires.

THE WORSHIPFUL COMPANY OF SHIPWRIGHTS.

THE Worshipful Company of Shipwrights, whose patron saints are Simon and Jude, dined in the Hall of the Fishmongers' Company on October 24th, on which occasion the Master, Professor J. H. Biles, LL.D., D.Sc., who occupies the chair of Naval Architecture at the University of Glasgow, presided, and was surrounded by many eminent members of the craft, including the wardens, Col. Clement Godson, M.D.V.D., Mr. J. B. White, the Right Hon. Sir Edward Clarke, P.C.K.C., past masters, the Right Hon. Lord Pirrie, K.P., Sir W. H. White, K.C.B., F.R.S., Sir Jos. Savory, Bart., and J. Last Sayer, Esq., C.C.; H. T. Bailey, Esq.; Chaplain, Rev. R. A. Clemens, M.A.; warden of the Fishmongers' Company, W. Haskett Smith, Esq.; Master Waterman's Company, F. Philp, Esq. There were also present the Lord Mayor, the Right Hon. Sir John Knill, Bart., the



Professor J. H. Biles, LL.D., D.Sc.,
Master.

Photo, Elliott & Fry.

Right Hon. Viscount Hill, L.C.C., the Right Hon. Lord Devonport, the Right Hon. Sir Geo. Reid, P.C., K.C.M.G., Vice-Admiral Sir R. A. Jellicoe, K.C.V.O., Sir W. T. Lewis, Bart., Sir Donald Macalister, K.C.B., Principal of Glasgow University, Sir Thos. Sutherland, K.C.M.G., Col. Sir Philip Watts, K.C.B., F.R.S., and others. Col. T. Davies Sewell, F.R.A.S., acting clerk and treasurer, we were pleased to see, occupied his usual place and gave that attention to the conduct of the proceedings which ensures order, comfort and pleasure to all concerned.

The Royal toasts were given and received as befitted the occasion. The Chairman then submitted the toast of "The Lord Mayor and Corporation of the City of London," commenting on the liberality of the city companies in cases that required help. The Lord Mayor and Sheriff Buckingham responded, each of whom paid a tribute to the memory of

ex-Sheriff Slazenger, whose death had removed from their circle one who was genial, hard working and conscientious in the discharge of duty. The sea forces of the Empire were proposed by Sir Donald Macalister, under the toast of "The Navy," which in its wider aspect as indicated by the proposer, embraced the oversea dominions within the area for defence, the presence of Sir George Reid emphasizing the fact. The name "Dreadnought" signified more than a type of war vessel, it was a motto, Vice-Admiral Sir R. A. Jellicoe responded; remarking on the many utterances and views urged upon the country regarding the Navy, he thought it better for the naval officer to avoid saying much about the Navy, as there were plenty of shore-going experts to write and talk about it to their own satisfaction. To talk about what the Navy should be and would be twenty years hence could be of no avail unless immediate action were taken to prepare for them. This view led to thoughts of the lock-out in the shipyards, a most disastrous affair for the country. The British shipbuilder held his own among the nations of the world; the *Olympic*, built by the Belfast firm, of which Lord Pirrie was the head, was the largest vessel yet built, and was to the national credit. The view of the Navy presented in its wider aspect was the correct one, not merely national, but representative of all parts of the empire, and with that steady progress forward and improvement on lines unfettered by party politics. There were now many trades required for the construction of a ship, but the shipwright had his own work and place still. He said that the Master, Professor Biles, had done valuable service on Admiralty

Coat of Arms of the Worshipful Company of Shipwrights.

committees, especially that on destroyers, and later on the "Dreadnought" Committee. Sir George Reid proposed "British Shipping," the growth and extension of which was one great wonder. It had gained its position and its carrying capacity not by being subsidised by the State, like the shipping of other nations, but by push and enterprise which all could support without waiting for a Parliamentary Act, by giving personal preference to imperial custom. The speaker declared for his part he had never voyaged—and he had started very young on his travels, being only two months old—in steamers other than those which flew the Union Jack. He knew many in Australia who adopted the same view and always gave the preference to British firms. Sir Thos. Sutherland replied to the toast; remarking on the needs of the port of London, he indicated that improvements might be looked for in the near future. The safety of life in the steamships of to-day was one of the great features to be proud of. The question of speed was one which the turbine could yet speak upon, it was still waiting to give further developments. The gas engine was coming into the field and its possibilities it was hard to predict. The "Shipwrights' Company" was given by Sir Robert Chalmers, who traced the shipwrights back to King Alfred, and pointed out that since its formation the guild had done good duty to the community and the country. The trade represented by the guild had been a powerful factor in the commerce and prosperity of London. The Chairman, as Master of the Guild, replied, and stated that, to qualify for the position he had served a seven years' apprenticeship to a master shipwright named Craddock in Portsmouth dockyard. The Shipwrights' Company was not wealthy, but it did good work with an educational fund which was available for rendering help to students desirous of serving apprenticeship or of advancing their education, but who had not the means of carrying this into effect. The "Visitors," proposed by Sir Edward Clarke, was responded to by Mr. E. T. Reed, whose father, Sir Edward, was well known, and his son promises to be no less known, although in a somewhat different craft, and by Prof. Latta

Col. T. Davies Sewell, F.R.A.S.,
Treasurer. *Photo, Elliott & Fry.*

(Glasgow University). Sir Fortescue Flannery proposed the Past Wardens and Masters, to which Lord Pirrie and Col. Clement Godson responded. Mr. J. Bell White gave the toast of "The new livery," which Mr. Chas. Ellis replied to. The musical programme was good and a pleasing effect of the proceedings, the dinner being served by the old and well-known firm of Messrs. King and Brymer.

The two latest recruits to the Guild are Mr. H. M. Grayson, the well-known shipbuilder and engineer, of Liverpool, and Mr. J. Howden Hume, of Messrs. James Howden & Co., Glasgow.

MESSRS. COCHRAN & CO., ANNAN, LTD., have supplied and fitted to each of the steamers *Anerley* and *Baron Renfrew*, a Cochran (Annan) donkey boiler, with patent seamless furnace.

XMAS PRESENTS.—Readers who are desirous of making instructive and interesting presents are referred to the list of technical books and photogravure prints of the battleship-cruiser *Lion*, full particulars of which will be found set out in the advertisement pages of this issue.

SUBMARINE OPERATIONS AT TOBERMORY.

FOR some time past public attention has been directed to the efforts made by the "Pieces of Eight" syndicate to recover the treasure-ship *Florentia*, of the Spanish Armada, which, according to various traditions, was sunk, as the result of an explosion, in Tobermory Bay, well over 300 years ago. The operations, suspended temporarily a few weeks ago, were sufficiently successful to warrant Col. Mackenzie Foss and those associated with him in coming to the conclusion that they had, at least, located *a* Spanish warship, and work will be resumed shortly under conditions of a much more definite character than those which attended the commencement of the work.

The search possesses considerable interest from an engineering point of view, for it is only by the employment of the most modern equipment that the searchers can hope to wrest from the bed of the West Highland bay its long-contained secret. The operations at Tobermory have been under the personal direction of Mr. W. G. Fitzgerald, managing director of the British Submarine Engineering Syndicate, who is also a managing director of the "Pieces of Eight" Co. It may be mentioned here that Mr. Fitzgerald has specialized largely in submarine work, not only in this country, but in America. He spent several years across the pond, his first experience in submarine work being in connection with the building of the Holland submarine torpedo-boat. Following upon this he had charge of the designing of the Lake torpedo-boat, another type of submarine which was built for the Austrian Government. This was followed by a period of service for the salvage department of the Lake Company in London. Recently he patented a new type of diving apparatus, which appears to have great possibilities in front of it and of which more anon. Mr. Fitzgerald was recommended to Col. Foss by the Lake Engineering Co.

The Syndicate commenced operations in August, and the equipment then consisted simply of a boring-apparatus, in addition to the diver. The latter was Diver Mackenzie, a Partick man of considerable experience, who had been engaged at several important recoveries, including the salving of H.M.S. *Gladiator*. His duty was to roam over the bed of the bay on a mission of enquiry, and he succeeded in recovering several pieces of African oak, which it required little demonstration to establish as being part of some foreign ship's timbers. The borer, which was rigged up on a pontoon, was supplied by a London firm, who make a special line of sinking Artesian wells in the metropolis, and the work it accomplished was of kindred character. The area of the bay-bed was mapped out and probed at regular intervals with the view of locating the hull of the long-sunk treasure-ship. The borer pierced with ease down through the sand, and at depths varying from 20 to 30 feet the hard blue clay was reached. During the course of these preliminary operations several interesting relics were recovered, and those at the head of the Syndicate were so impressed with their finds that other and more powerful machinery was pressed into service. Accordingly, about the second week of October, a start was made with a powerful suction pipe, erected in the lighter *Sealight*. The suction pump had a diameter of 12 inches, and was slung over the starboard bow of the lighter, the pump being erected forward. From the pump another pipe of similar diameter was continued overhead and aft to the stern, over which was fitted a close-meshed screen, into which the water and material sucked up by the pump were discharged. Objects as small as sixpence were retained for inspection, but the water, sand, sludge, etc., passed out and into the Bay again. The success of the pump's work was instant and satisfactory. The attention of Mr. Fitzgerald had been directed to a mound of sand about 100 feet long, and which sloped gently upwards to a height of about five feet. He instructed the divers, who in turn directed the nozzle of the pipe beneath the water, to concentrate their efforts on this bank, and so the top of it was gradually stripped off. As this work progressed, many important finds were made of African oak, ancient military relics and a few pieces of Spanish money, dated 1586. It should be mentioned here that, as a result of experiments made with the borer, it was anticipated that the searchers would only have sand and sludge to deal with, but it was found, when stripping the mound that there was underneath a dense and compact mass of cobble-stones and clam-shells. It was conjectured that these formed part of the *Florentia's* ballast, but however interesting that might be as a fanciful speculation, there remained for the engineers the hard and unwelcome fact that they had encountered material with which their pump equipment was not fitted to deal. Mr. Fitzgerald was on the point of withdrawing his men from the spot when he noticed that one of the divers came up with the legs of his diving suit deeply stained with iron rust. Further search among the stones revealed great masses of decayed timber and iron, also other and more valuable evidence of the ship's presence. It was agreed that the right spot had been found, and attempts were made to continue the pumping, but it soon became manifest that, as already indicated, the gear was not equal to dealing with stones and other kindred material. Added to this was the circumstance that the days were shortening and weather conditions unpromising, so it was agreed to suspend operations in order that pumping equipment might be installed which would deal with any kind of material. On the point of future operations Mr. Fitzgerald was most explicit to our representative. He said it was their intention, on the resumption of work, to dredge up every ounce of material from the spot right down to the hard clay, as no doubt existed in the minds of any of them that they had located the site of the wreck. An incident may be stated to show the force of the pump. Diver Mackenzie happened to pass too close to the nozzle one day when down below, and the suction drew his heavy knife out of its sheath, whirled it up through the pipe, and cast it with considerable force into the screen. Apart from the definite results which have been gained at Tobermory, the operations have considerably stimulated submarine research, especially in the way of recovering sunken valuables. All over the globe there are many spots where it is known that fortunes lie awaiting salvage, but hitherto the want of suitable equipment has interposed an effectual bar. Reference has been made to the diving gear patented by Mr. Fitzgerald, and for this it is claimed that it will now be possible for divers to work at depths which were formerly prohibitive. In this connection it is worth mentioning that Mr. Fitzgerald is in negotiation with a Syndicate for the raising of a great number of bronze guns which were sunk during a famous naval battle in Eastern waters something like a century ago. The spot has been located, but the depth of water has up till now rendered salvage impossible. Further developments in the way of submarine search and recovery cannot fail to arouse interest, for it is a branch of engineering science as yet in its infancy.

JOHN'S PATENT PUNCHING, SHEARING AND CROPPING MACHINES.

THE Stand of Messrs. Henry Pels & Co., of 9, Portsmouth Street, London, W.C., at the Manchester Exhibition, was certainly one of the most striking in the Hall. There were six power-driven machines in operation, and a number of hand lever tools, which could be used for every description of punching, shearing, cropping, notching, etc. Of special interest is the John's Patent One-Stroke Joist Shears, Type R.T.V., illustrated in Figure 1, which is remarkable for its rapid cutting action, the handling of the girder being reduced to a minimum. The Shears cut at one stroke, joists, channels or other sections, and we understand that the largest size built will deal with the largest girder rolled. We saw a channel 12 inches by 4 inches severed in ten seconds, and noticed that all sections were cut by means of the same upper blade, while the side blades were simultaneously adjusted, by means of gearing and hand wheel. The bottom blades are hinged to spindles, and are easily raised into position. The machine is driven by means of spur gearing, which acts on an eccentric shaft carrying a plunger, and the top blade gradually descends and cuts right through

the girder at one stroke, perfectly clean cuts being produced. After the cut, the plunger is disengaged, and the slide is automatically raised by means of two balance weights, and brought into its original position. The frame of the tool is constructed of Siemens-Martin steel plates, and though the machine is comparatively light in weight, and takes up only little space, its design is most rigid and substantial, and should appeal to shipbuilders and structural engineers,

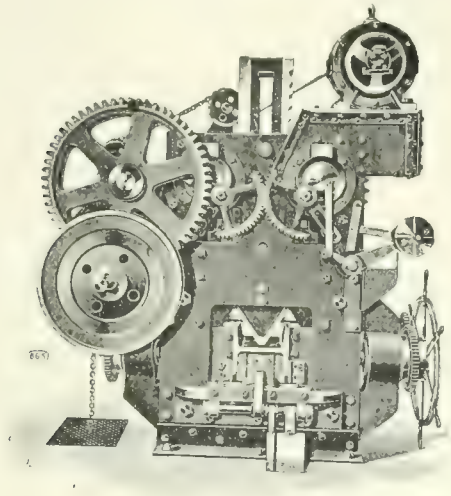


Fig. 1.

in fact, we understand that numerous machines have already been sold to continental and colonial firms. The machine exhibited was a comparatively small one, driven by belting from electric motor, and it was obvious to us that the machine is so simple, that unskilled labour may be used for its manipulation.

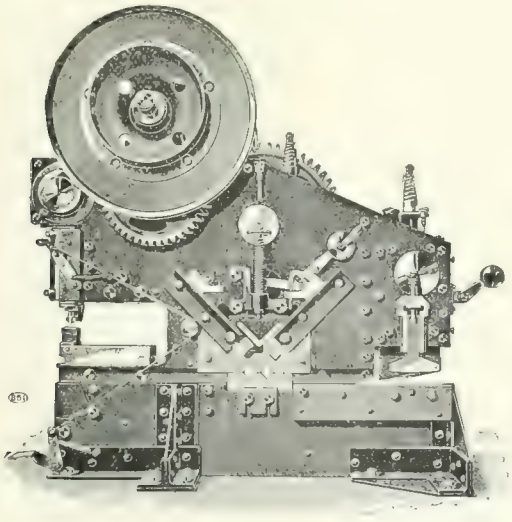


Fig. 2.

A machine which will appeal to engineers of every description, is the John's Splitting Shears, combined with Universal Punching Machine and Bar, Angle and Tee Cropper, Type R.B.L.U.E.F., Figure 2. The shears of this tool will deal with plates of any length or width, *i.e.*, the plate can be fed right through the body of the tool. A most perfect down-holder is provided, which can be readily adjusted for any thickness of material. The punching end is arranged for intermittent and continuous punching, and can be engaged by hand or by foot; the slide may be unlocked so that the punch will "play" on the plate, in addition a special lever is provided, by means of which the punch can be placed on the centre mark, while the machine is in motion, and the hole is made without the punch having previously risen. Wrong punching is, therefore, entirely avoided. In the centre of the frame a cropper is arranged, which deals with rounds, squares, angles and tees, without having to change any blades. An attachment is provided enabling angles to be cut on the bevel up to 45 degrees. Each of the respective tools has improved stop motion, and can be worked independently, or all tools can be worked simultaneously at their maximum capacities. The punching, shearing and cropping results obtained are excellent ones, the machine runs silently and smoothly, and we understand that wherever installed has given the greatest satisfaction. The frame of this combination has especially heavy Siemens-Martin steel plates, which get very near what might be called "armour plates."

We also saw in operation, the combination of John's well-known Patent Joist Shears, which works at two strokes, with Punching Machine, Type R.T.L.U., a John's Patent Bar, Angle, Tee and Channel Cropper, Type R.E.F.F., which is largely used by Shipbuilders, Railway Companies, etc., John's Patent Bar, Angle and Tee Bevel Cropper, Type R.G.E.F., which can be found in nearly every shipbuilding yard of importance, and John's Patent Double-Ended Notching Machine, Type R.A.T., which is the tool *par excellence* for shipbuilding yards.

The various combinations of Hand-Power Punching, Shearing and Cropping Machines, worked by gear and lever, attracted considerable attention, and we are informed that a number of orders were placed by well-known shipbuilders for tools of this description. They are comparatively light in weight, take up only little space, and if mounted on a trolley can be taken about anywhere to the work, instead of taking the work to the machine.

Messrs. Leonard Chapman & Co., Ltd., Importers and Manufacturers, Munton Road, London, S.E., report:

Graphite, as imported, according to quality.

	£ s. d.	£ s. d.	
Ceylon L.L. c.i.f. London ..	16 5 0	to 38 10 0	per ton
,, O.L. ,, ..	11 9 6	to 38 9 6	,,
,, chips ,, ..	9 5 0	to 28 0 0	,,
,, dust ,, ..	9 10 0	to 25 0 0	,,
Purified, milled and ground.			
Ceylon, 97% to 99%, f.o.b. London	59 0	0 to 63 0	0 per ton
,, 90% to 91% ,,	40 0	0 to 42 0	0 ,,
,, 80% to 81% ,,	30 0	0 to 32 0	0 ,,
,, 70% to 71% ,,	27 0	0 to 28 0	0 ,,
American large flake, f.o.b. London	45 0	0 to 49 0	0 ,,
,, small ..	35 0	0 to 45 0	0 ,,
Joint Compd. per cwt.	2 9	0 to 2 12	6
Paint Paste ,, ...	2 2	0 to 2 5	0
Paint per gall.	0 4	9 to 0 5	3

Wholesale lists of tinned goods on application.

INSTITUTE OF MARINE ENGINEERS.

20th Annual Dinner.

THE twentieth annual dinner of the Institute was held in the King's Hall, Holborn Restaurant, on Friday, November 4th, 1910. The assembly of members and friends, which numbered about 320 in all, was presided over by Sir David Gill, K.C.B., F.R.S., D.Sc. (president of the Institute), and the gentlemen present at the President's table were the Right Hon. Lord Strathcona and Mount Royal, P.C. (High Commissioner for Canada); Sir William H. White, K.C.B., F.R.S., D.Sc. (past president); Sir Owen Phillips, K.C.M.G., M.P.; Sir William Hall-Jones, K.C.M.G. (High Commissioner for New Zealand); Sir John Taverner (Agent-General for Victoria), T. A. Coghlan, Esq., I.S.O. (Agent-General for New South Wales), Major P. A. MacMahon, D.Sc., F.R.S. (Assistant Warden of the Standards), Professor F. W. Dyson, M.A., F.R.S. (Astronomer Royal), James Denny, Esq., (past president), D'Arcy Dawes, Esq., John A. F. Aspinall, Esq. (president, Institution of Mechanical Engineers), Professor Archibald Barr, D.Sc. (president, Institution of Engineers and Shipbuilders in Scotland), Colonel R. Saxton White, V.D. (president, North-East Coast Institution of Engineers and Shipbuilders), Dr. Robert Caird, Messrs. Summers Hunter (vice-president), Alexander Boyle, (Chief Engineer-Surveyor, Board of Trade), Andrew Scott (secretary, Lloyd's Register of Shipping), Dr. S. J. P. Thearle (Chief Ship Surveyor, Lloyd's Register), John Gravell (Bureau Veritas Registry of Shipping), J. Foster King (British Corporation Registry of Shipping), Jas. Adamson (hon. secretary), Captain G. F. Dixon, James McKechnie and E. P. Grove.

After a reception by the President in the Throne-room, dinner was served in the King's Hall.

The Royal toasts having been proposed and received with acclamation, the President gave the toast of "The Imperial Forces," and said that at present all realized the importance of maintaining the efficiency of those forces. He had no sympathy with the man who wanted to be brought up by the State for nothing, educated for nothing, to pay no taxes and to enjoy an old age pension, and yet would do nothing for the defence of the country. The toast was coupled with the name of Colonel R. Saxton White, for thirty years a Volunteer, and who for thirty years showed an example of what every Britisher ought to do.

Colonel R. Saxton White, V.D., said that one of the first instructions to a young officer joining His Majesty's service was that when he received an order he was not to consider it, but to carry it out. Such an order he had received to respond without preparation to the toast, but when he had before him such a gathering of enthusiastic countrymen to appreciate any tribute to the men who are doing their duty to the country in His Majesty's forces, he was not overwhelmed. The warships of the "Dreadnought" type, by the rapidity in construction and the enormous increase in the power of the unit, did, in fact, only about five years ago, mark a tremendous advance, and yet to-day we had a type of vessel which marked a greater advance still, and while there were men at the head of affairs capable of designing and constructing such ships as the *Orion* and the *Lion*, we need have no fear for the defence of our country. The Navy was the most important line of defence, and the very best men were needed to see it kept in the most efficient condition. Regarding the land forces of His Majesty, there was no doubt we had an army of the very best, supplemented by the Territorials—good for the price we pay. There should be no occasion even to make that reservation, and if the British public, as represented in the House of Commons and the Government for the time being, would only put before the British taxpayer the necessity for increasing the efficiency of that part of the service, he believed he would be prepared to "foot the bill" for the defence of his country.

Sir Walter J. Howell, K.C.B., said he could not imagine a toast more likely to arouse the enthusiasm of such a gathering than that of ships, colonies and commerce. Under modern conditions, it was vital to the very existence of this country that commodities should be brought in ships from foreign countries and from the great dominions and colonies of the empire. Those ships must be protected by other ships, and, in fact, the necessity for a Navy, and for an overwhelmingly strong Navy really sprang from the existence of a great mercantile marine. There were three things, commerce, with the necessity of exchanging products, ships, by which the exchange is carried out, and colonies, or as now called oversea dominions, which facilitated and enlarged the operations of shipping and tended to protect it by multiplying points of safety. All alike vital. That, indeed, without a triple alliance of this kind the British Empire, as it stands to-day, could never be maintained, and indeed could never have come into being. Lord Strathcona, he continued, was held in affectionate esteem and regard in the dominion across the Atlantic, which he so worthily represented, and that regard was shared to the full by all in the Mother Country. Lord Strathcona was regarded as one of the really great personalities of the empire. His geniality, his invariable kindness, his generosity and his princely hospitality have endeared him to all. Sir Owen Phillips had already gathered many laurels in his chairmanship of the Royal Mail Steam Packet Co.; he was one of the leaders of the new Port of London Authority, and upon him the mantle of the late Sir Alfred Jones had fallen, and with their names he coupled the toast.

The Right Hon. Lord Strathcona said it was some seventy odd years since he first, like many aggressive Scotchmen who left his home "to look after other people," went to Canada. What was known of Canada then? What commerce was there between it and this country or any other country? There were none of those millions of bushels of wheat and grain that we have to-day, but timber and furs sent by the Hudson Bay Company, the great power in that day and with whom he commenced his career. What did we know of Australia at that time? New Zealand had no existence. With regard to South Africa, it was the Dark Continent, nothing practically was known of it. Although he more specially thought of the progress of Canada, the progress made in Australia, New Zealand and South Africa compared very well with that in Canada. Forty years ago there were 200 white people altogether connected with the Hudson's Bay Company; to-day there was a population of 150,000, not only so, but surroundings, buildings and a city which would compare well with any one of the same size on either side of the Atlantic. As with Canada, so with Australia and happily, also now with South Africa, where the Duke of Connaught had recently been on the part of the King, opening the first Parliament of the United South Africa. No association and no body of men had done more towards this progress in Canada and the outlying portions of the empire than marine engineers. He could look back to the time when an engineer meant a civil engineer. They were not divided into the different branches, mining, marine, electrical, mechanical and civil engineers, each and all doing the great work of progress throughout the world and without whose efforts the results of to-day could not have been. The time it took to get to Canada some fifty or sixty years ago was six weeks, and to-day we get to Montreal in about six days. He looked forward to the time when Montreal could be reached from London in four days or so. Then on to Vancouver in eight days, and instead of the thirty-three to thirty-five days to reach Australia it would be reduced to three weeks.

Sir Owen Phillips also responded. He said ships and commerce were bound up together and it was a very big subject to speak about, but these were the days of big things, the days of big combines, whether looking at Canada, which Lord Strathcona had referred to, or Australia, where six states were bound into one Commonwealth for the good of that portion of His Majesty's dominions, or South Africa, where four states were combined into one United South Africa, for, it was hoped, the prosperity of that portion of the empire which had hitherto been so disturbed. In London itself, six separate undertakings had been bound together in the Port of London Authority, and which, he believed, would be for the good of the shipping of the kingdom. Ships also, both naval and mercantile, every year were becoming bigger and bigger. But a few days ago there was launched at Belfast the largest ship ever built, and it was said that in another country there was a still larger ship to follow. There was no limit to the size of ships. Shipowners had hardly discovered the great advantage that triple-expansion engines had over compound, when it was shown that triple engines were of little use, and that only quadruple engines could hold their own in these days of keen competition, and no sooner had shipowners time to

adopt, at least to some extent, the quadruple system, when it was said "That is of no use, you ought to have turbines." Then it was a question of turbines or a combination of turbines and reciprocating engines, and there was hardly time enough to think of that subject, let alone to bring a fleet up to modern requirements when internal combustion engines came forward. He did not know what might be the future of the marine engine, but felt certain the marine engineer would be equal to the emergency, and would do his utmost to keep the British mercantile marine in its place in the front of the world. When attention was turned to the shipping companies they, like the ships, were becoming bigger and bigger, but as a patriotic Briton, he was sorry to see that, of the three largest shipping companies of the world, none of them were British owned, and he thought there was room for this country, which owned more than one-half of the ships of the world, to take a still bigger position. Ships were getting safer, and undoubtedly more comfortable, and that was encouraging people of all nationalities to travel more by sea than they did in the past.

Sir William Hall-Jones said it was mentioned by Lord Strathcona that seventy-five years ago New Zealand was not known. It was only some seventy years ago that it became a British possession, and for the greater part of his life he had lived in New Zealand, and as some fifteen years ago he had the honour of being made a Life Associate of the Institute of Marine Engineers in New Zealand, he had great pleasure in proposing the toast of "The Institute of Marine Engineers." He always had the greatest respect and admiration for marine engineers, having travelled a great deal and seen a great deal of life on board ship, and there was always one question which puzzled him, as to who was the greater man on board ship. Marine engineers were respected the whole world over, and the Institute held the admiration, not only of the general public, but of the shipbuilders and the great shipping companies. There had always been a rarity of disputes between the shipowners and the engineers, attributable to the good sense and the sense of justice which prevailed amongst the engineers. Our sailors in the past were those who discovered distant countries, and it was our sailors and our engineers of to-day who were keeping those countries together. When we considered the immensity of the commerce between this and other countries, we could not but remember that all depended upon our ships and upon our marine engineers on those ships to look after their progress. The oversea trade of the empire was something over £1,200,000,000, and Sir Owen Phillips had mentioned that we possessed more than one-half of the ships engaged in commerce throughout the world. Looking at these figures he did not believe those who speak of the decadence of this country and those who say we are falling behind in the competition with other countries. It was well to be on the alert, to keep as far as possible to the front. It must be borne in mind that those countries called colonies, which were spoken of as the dominions over sea, were growing up, increasing in population and trade in greater and greater ratio every year, and that throughout the empire there was a strong feeling of kinship which would continue to grow in intensity. Whether one went to Canada, Australia, New Zealand or South Africa, it would be found that representatives of every part of these islands were there, and they all spoke in the dearest terms of those left behind them. Imagine those young countries growing into nations, trade always expanding, and all in the colonies and in this country doing their share to improve the good feeling and to extend trade and commerce. Since he had been in this country, for over two years, it had been impressed upon him that there was a desire that the mutual assistance and unity should be continued and extended. It was for the advantage of the people as a whole, and he agreed with those who said "Let us have a quicker service." The parts of the empire could not be brought nearer, but we could approach them in a shorter time. It was his pleasing duty to propose the toast of "The Institute of Marine Engineers," coupled with the name of the hon. secretary, whom, not long ago, he had the honour of decorating with the Gold Emblem of the Institute of New Zealand.

Mr. Jas. Adamson responded on behalf of the Institute, and said that the words and the sentiments expressed by the proposer would echo and re-echo from the walls and be wafted over land and sea, to find receptive chords to respond among those on whose behalf the Institute was founded and is carried on—the marine engineers of the empire, whether in the Navy or the mercantile marine, on whom so largely depend our welfare, our prosperity in commerce and our defence in war. Did the executive of the Institute, individually and collectively, need inspiration to carry on the work with vigour, they had it in looking around the assembly and pondering over the language of him who had spoken so eloquently on behalf of their calling. The enthusiastic working members, both in the Council and outside the Council, who exercised themselves in self-denial in connection with their operations, had received a fresh stimulus, and he did not doubt but that excellent results would follow from the assembly, giving an incentive and impetus towards greater progress and further advancement in the direction of increasing membership and a closer study of those questions which make for improvement in efficiency and economy—attendance at the reading of papers and discussions being one of the means provided, and a very important one, among those which comprised the list of outlets for beneficial—or he might say beneficent—work carried on. They had been reminded of their duty to their day and generation in respect to the engineering questions daily calling for solution and, beyond that, their privilege of providing fresh questions for the generation to follow—the marine engineer of the days to come. Such thoughts incited them to go ahead with that renewed energy and enthusiasm which made for success in any undertaking. That they were alive to both their duty and their privilege was evidenced by the monthly issue of Transactions. The frequency of these issues kept members in closer touch with the most recent developments and, while they were conscious of fulfilling their mission to some extent, the glut of satisfaction did not possess them—they were ever aiming at higher ideals, and let it be the aim of every member to help them to press on, improving on past records, bearing aloft the lighted torch of progress. Were they not all looking forward with anticipation to that day when the special committee to whom had been entrusted the continuation and carrying into fruition the work, should have completed their labour and placed a commodious and well-appointed city residence at their disposal—a new and other habitat for the Institute which they could look upon with pride and satisfaction—a fit companion building in keeping with those of kindred institutions, which were older in years, but not of greater importance to the community. One of the pleasing features which had been getting into shape of recent years in connection with their operations was the Junior Section, and now there were a good number of young men, not only deeply interested in the Institute, but doing well in promoting the aims set forth in the Articles of Association. Not the least pleasing detail was that the sons of many old members were entering the field possessed by their sires, whose strenuous efforts had helped to extend its area and to open wider the gate by contributing their ripened experience. The awards presented at the last meeting on Monday night, when they were privileged to listen to the address of their president, was another pleasing detail, and the fact that he who obtained the Lloyd's scholarship last year had now taken the B.Sc. degree was a source of gratification to the junior section. The social side had not been overlooked, nor was it made too prominent, and he had found it to be a valuable auxiliary to the more solid and permanent side. That evening's gathering indicated the interest taken in the great social event of the year, and even in the smaller events the accommodation in their own premises was inadequate to give sitting room for all. The membership was steadily increasing, their operations were in good trim and the programme for the current session contained good subjects for thought, enquiry and discussion. What was wanted to make the subject matters highly interesting and valuable was a full attendance of members in order that the views of many minds might be expressed for the benefit of all.

James Denny, Esq., proposed the toast of "Kindred Institutions." Some of them, such as the Institution of Civil Engineers and the Institution of Mechanical Engineers, might be said to have attained a ripe old age, but for the fact that before each of them was a long and prosperous career, but whether old or young they were doing most excellent work. They contributed to the spread of technical knowledge and also to social intercourse amongst gentlemen associated in the same line of business, who might otherwise be kept

apart by personal or trade jealousy. When one thought of it one must wonder how such institutes came to exist at all. Their actual outcome was that the more capable members willingly and gratuitously handed over to the less efficient members much of such knowledge, special experience and valuable information as they possessed. The result was the advancement of technical knowledge, whereby the trade of the country was much benefited. All this applied to their own Institute, which was prospering all the time. Members increased, its funds seemed to augment almost automatically and the value of its proceedings, both in range and in quality, anyone who read the monthly Transactions could verify. But great as its progress had been, it had not marched fast enough to please its members. It was considered that the Institute had outgrown its rooms at Stratford, and that a necessity was almost laid upon it to have premises in the city. Something had to be done to meet this laudable ambition. This was no rash scheme taken up at a moment's notice. It had been before the whole of the members of the Institute on at least three of its annual meetings. Means had been taken to ascertain the views of the individual members of the Institute. A special committee was appointed to investigate the whole question, especially as to site and cost. The views of the members generally were favourable and the scheme was to go on, or at least it would go on if sufficient financial support were promised. For the information of those who were not members of the Institute it might be said that an appeal would shortly be made to the members of the Institute themselves and to the friends of the Institute, to shipowners, to shipbuilders and to marine engine manufacturers, to everyone who might be supposed to be interested in the future and the welfare of the marine engineer. As one of the past-presidents of this very valuable Institute, he ventured to recommend a very favourable consideration of this appeal, when it reached those to whom it would be made and who might be supposed to be interested in the question. As far as shipowners, shipbuilders and marine engineers were concerned, it would be for them a casting of bread upon the waters, for anything they could do to improve the status and the welfare of the marine engineer came back to them to their own advantage. Now that tonnage was being better employed, that freights were higher, they might perhaps cherish some hope from the shipowners to whom they might appeal. As for shipbuilders and marine engine builders, quite admittedly business with them had not been in a satisfactory condition, but even from them they should get considerable assistance. Referring to the present condition of affairs, he could consider it had arisen from the fact that both sides were satisfied they were fighting for what they called a principle, and when people fought for a principle any reasonable accommodation between them was very difficult to arrive at. They could come to a settlement much more quickly if outsiders would not interfere. There were certain principles underlying the situation which could not be affected by the unsolicited counsel of a labour leader, eminent economist or epigrammatic playwright. An industry to be successful must be properly organized and properly disciplined. The situation appeared to be not entirely due to the special merits of the dispute. There was a feeling abroad that Labour was not getting what was called a fair share of the profits. Well, he would say to the irresponsible outside advisers that they might make their minds easy on this point as far as the shipbuilding industry was concerned. Never during the period of forty-five years he had been connected with it had the returns to capital been less, or what was paid to labour more. There was admittedly unrest in "labour" in this country, and others. As far as this country was concerned it seemed to be due to the fact that labour, having had through its vote political power for forty years and having exercised it with moderation had begun to realize what this power really meant. The hope for the future must be that our democracy, along with its realization of power, might realize also its responsibility.

John A. P. Aspinall, Esq., president of the Institution of Mechanical Engineers, responded.

Mr. Alexander Boyle (vice-president) proposed "The Guests," and Professor Archibald Barr, D.Sc., responded.

Professor F. W. Dyson, M.A., F.R.S., in proposing the health of the President, said, "The Institute has conferred a great honour on me in asking me to propose this toast of 'The Chairman' and I am very proud to do so, especially as Sir David Gill is a great astronomer in whose steps I try to follow as well as I can. If it were not too late I could tell you a great deal of what Sir David has done. He has measured the distance of the sun, but that is only a small matter of about 90 millions of miles, and he has measured the distances of stars millions of times further than that. Not content with that he has surveyed a large part of South Africa, and started to measure the great arc of the earth's surface on the 30th meridian in that country. These tasks of Sir David's involve some of the qualities which are possessed by engineers. The instruments which astronomers use need a lot of looking after just as the engines of a ship need looking after, and it is largely, I think, through his mechanical instinct and through his grasp of engineering conditions that Sir David Gill is such a brilliant astronomer as we all know him to be. For nearly thirty years he was H.M. astronomer at the Cape of Good Hope. During that time telescopes and astronomical instruments have changed just as marine engines have changed, but in 1879 he found there the old engines of that date, and has left the Cape Observatory with new engines of the date of 1910. Not only in astronomical circles but in other scientific and in all circles at the Cape Sir David was an extremely useful and prominent man. He is now back in this country and it is a great pleasure for us to have him as president of the Astronomical Society, as it is your pleasure to have him as president of your Institute. Gentlemen, I give you the toast of 'The Chairman.'"

Sir David Gill, K.C.B., in response said, "The hour is late, else I should like to have extended my words of thanks to you for the cordial reception you have given to this toast; but I know many of you have trains to catch, and most of you will get a 'curtain lecture' when you get home, so I shall spare your feelings. But I do thank, first of all my colleague and dear friend, Professor Dyson, and I am sure you, with me, will offer him your warmest congratulations on his recent appointment to the important post of Astronomer Royal. Few scientific events have given me more cordial pleasure than that appointment. We have in him a man of tact and judgment and who, from his University days, has been a Government servant of the highest standing. He has fulfilled the great expectations raised by his brilliant University career, and I am sure he will fill the post with the greatest benefit to science. Of what he said of myself, the less I say the better. I can only say that he has presented my case in a favourable light, much too favourable in my eyes. As to the Institute of Marine Engineers, why they chose to appoint me their president I do not know, although it has been a very, very great pleasure and honour to occupy that post. In speaking the other night I said he would be a fool of an engineer who did not take an interest in his tools, and he would be a fool of an astronomer who did not take an interest in his tools also. In taking that interest I have become more and more of an engineer, and it was on that account I felt in such full sympathy with this Institute that I at last consented to give my feeble efforts to help forward its interests. If in any way I can do anything for the Institute it will be my pleasure and a poor return for the honour you have done me."

WE have much pleasure in advising the old students of the City Engineering Academy, of 4 and 5, High Street, Aldgate, E.C., London, of the recent success at the Board of Trade Surveyors' Examination held in London in October, this Institute's students securing both the first and second place. Also at a recent examination by the B.T. for Surveyorship under the R.I.M. a student secured first place. This school also obtained the only success at the October Extra Chief Examination in London.

MR. AND. JACOBSEN has placed an order for a new steamer with Messrs. Priestman & Co., of Sunderland; 346 ft. long, 50 ft. 8 in. beam, 24 ft. 7 in. deep. The engines will have cylinders 24½ in., 40½ in., and 67 in. diameter by 45 in. stroke, with two large single-ended boilers, to be built by Messrs. The North-Eastern Marine Engineering Co., Ltd. The engines will be worked with superheated steam on the Schmidt system.

MESSRS. PRIESTMAN BROS., LTD.—We are informed that the Priestman Grab-Dredger, Excavator and Elevator has been awarded the "Grand Prix" at the Buenos Aires Exhibition.

CORRESPONDENCE.

(We do not hold ourselves responsible for the opinions expressed by our correspondents).

To the Editor of THE MARINE ENGINEER AND NAVAL ARCHITECT.

Dear Sirs,—As a constant reader of your valuable paper, "The Marine Engineer and Naval Architect," I notice the article in October number on Steam Whistles for signalling in which the Board of Trade have interested themselves. It may interest you to know I have studied the matter for a long time, and have brought out an invention of my own, which has given the utmost satisfaction in our steamers for for seven years.—Yours faithfully,

J. E. SPURGEON.

Alexandria, Egypt, 21/10, 1910.

To the Editor of the MARINE ENGINEER AND NAVAL ARCHITECT.

Dear Sir,—Glad to see your leader on steam whistles. Don't you think that the adage, "Prevention is better than cure," is applicable specially to this question?

My investigations into the courses of steam and water currents in steam piping placed at all angles and relative positions have shown me that dry steam can be economically supplied, or kept ready, for all purposes by arrangements on the principle of induced circulation, as in my patent steam whistle method.

In answer to an inquiry I had a letter from the Board of Trade dated 7th February, 1910, stating that "though it is considered that the whistle pipes should, as a rule, be separate fittings from the boiler or boilers to the whistle, other arrangements are not objected to, if proved on actual trial to be satisfactory." This I take to mean that any efficient arrangement would be approved of.

The Dutch Government prescribe in "Staatsblad No. 315 (Scheperswet)" par. 3, Artikel 31—

"The steam whistles and syrens for making fog signals should be so arranged that when there is steam up they are always ready to immediately sound, and should be placed at a sufficient height to prevent the sound being obstructed."

I have suggested three tests to the Board of Trade as follows:—

1. During the first blast, under sea-going conditions, nothing to be seen passing between whistle ports and tops of openings in organ pipe or dome of whistle. Anything *seen* to be assumed to be water.

2. The full sound of unvarying tone and power to begin and end sharply and coincidently with the opening and closing of whistle valve.

3. After twenty-four hours' silence the whistle to be sounded again, with results exactly similar to 1 and 2.

Trusting that you may find something in the above which may be of use, believe me, yours respectfully,

J. H. YATES.

Rotterdam, 1 November, 1910.

* A descriptive article on Mr. Yates' system appeared in February, 1910, and may be further referred to in a future issue.—ED.

REVIEWS.

The Indicator Handbook. By C. N. Pickwick. 4th edition. London: Whittaker & Co. Manchester: Emmott & Co. Price 3s. nett.

This practical manual for beginners has been revised and enlarged and a fourth edition is now published. This book in its previous editions has been recognised as one of the most useful books on the subject, particularly from its educational value to beginners, and the author has done wisely in bringing the work up-to-date in order to comply with present-day requirements. The prominent position taken to-day by gas and oil engines has necessitated the inclusion of a special new chapter on the class of instruments manufactured for this class of prime mover, and the details of use necessitated by the new conditions obtaining. Some useful descriptions and illustrations of reducing gears for gas engines are now included, while optical indicators, pressure indicators and other such devices have received attention. A number of illustrations have been added to the work, so that the description of apparatus is rendered more easily comprehended. It will be agreed that the book in its present form is really a most useful companion volume to "The Indicator Diagram: Its analysis and calculation," by the same author.

Design of Marine Multitubular Boilers. By James D. McKnight and A. W. Brown. London: The Technical Publishing Co., Ltd. Price 3s. 6d. nett.

This is a treatise written by two practical engineers on the details of design relating to Scotch boilers in order to assist draughtsmen who have not had the opportunity of experience of this class of practical work. There is no doubt that much greater facilities exist for obtaining knowledge of design of engine work than of boilers, and it is to fill this deficiency in some measure that the authors record the principles which they recognise as controlling the practical design of this particular type of boiler. The book opens with the usual particulars of a boiler and the views that are necessary to impart the proper information to the boiler maker. The subjects of tube spacing, furnaces, firebox side stays, firebox top staying, staying of the top front and top back ends, staying of firebox backs, and details of shell riveting, maximum pitch for riveted joints, bottom water space stays, front and back tube plate staying, effective area of stay tubes, details of portable stays, the "Ashlin" removable furnace and detail of a reverse flange type furnace are there dealt with in turn. In each section representations are given showing constructional and dimension lines with the necessary dimensions and information just as the working drawings should have, and the description referring thereto includes all the arithmetical calculations involved in the preparation of the design. The requirements of the Board of Trade, Lloyd's, and the British Corporation surveys are all given and applied in the necessary directions for obtaining the proper dimensions and arrangements. On the whole we think the book will serve a useful purpose.

Steam Turbines. By W. S. Leland. London: Messrs. Crosby, Lockwood & Son. Price 4s. 6d. nett.

The above book is one of a series of sixty volumes prepared by the American School of Correspondence of Chicago, and issued as it is at such a moderate price, serves well as a preliminary study for the principles of steam turbines, and the fundamental principles are most legibly put in the first chapter. The distinction between an impulse turbine and a reaction turbine is well set out, though as turbines are now made none of these are effectively impulse or reaction turbines, but the explanation is very clearly given as to the difference of these two principles. Remarkable advancements have been made in the development of the turbine in the last ten years, and this has given a great incentive to steam engineering, whilst the electrical engineer has been stimulated to work out new ideas in designing generators suitable for the very high speeds of rotation. The steam turbine has now taken its place beside the best reciprocating engines of the present day, and is likely to find in the immediate future a more serious competitor in the gas engine than in the reciprocating engine. After this first long chapter upon the theory of the steam turbine we come upon Part II., which deals with commercial turbines, starting with what may be termed the simplest type of turbine, *viz.*, with a single set of nozzles and a single rotating wheel, which may be set down as a single-stage impulse turbine, or the De Laval steam turbine. After this the Riedler Stumpf turbine is described with plenty of illustrations, on which follow the Levy and the Sturtevant turbines. Then comes the Rateau turbine, as an exemplification of the compound steam turbine, and finally the Curtis steam turbine, of which there are many illustrations. Under the heading of reaction turbines mention is made of the Hon. Chas. Parsons as being the responsible man for the successful development of this class of turbine, and illustrations of the rotor and sections are shown through the rotor in place. Afterwards several devices of governors are described, (1) those in which the pressure of steam before admission to the steam chest is controlled by a throttling governor; (2) those in which a series of nozzles may be controlled by a valve operated by a governor, and (3) those in which steam may be admitted at full pressure at intervals, either of long or short duration. This completes this book, which is a well compiled and succinct account of steam turbines.

BOOKS RECEIVED.

Spark Spectra of the Metals. By Charles E. Gissing, F.R.G.S. London: Baillière, Tindall & Cox. 21 pages, 50 illustrations. Price, 7s. 6d.

The Royal Navy List. London: Witherby & Co.

Mechanical World Pocket Diary, 1911. Manchester: Emmott & Co., Ltd. Price, 6d.

English Prices with Spanish Equivalents. By S. Lambert. London: E. & F. N. Spon Ltd. Price 1s nett.

"Manulav."—We have had an opportunity of testing the soap manufactured and sold under this name by Messrs. Price's Patent Candle Co., Ltd., of Battersea, and can certify it to be most useful to those who are called upon to soil their hands, by contact with machinery, tools or other implements, as it removes most expeditiously ingrained greasy dirt or abraded metal. It is made from the best materials, is free from harmful chemicals, while a sufficient quantity of Messrs. Price's Glycerin is added to protect and preserve the skin. It is sold in single tablets or in boxes of three and twelve tablets at a moderate price.

The Beldam Rubber and Packing Co.—This firm, established in 1876, has just issued a new catalogue comprising within its pages a description of the different specialities manufactured at the works at Brentford, Middlesex. Gold medals were awarded to the firm at the Milan and Shepherd's Bush exhibitions. For the benefit of customers the A.B.C. and the engineering standards vol. v. (Messrs. Atkinson) codes are used. The Excelsior metal rings, duplex, are of the spring backed encased type. The rings are held up to their work by springs; there is a drain connection from a recess under the upper set to the I.P. receiver and from the lower set to the L.P. receiver. The ordinary type of Excelsior packing has rings of the same kind in one case. Each type is in use for piston rods with 220 lbs. pressure. Soft packings of various kinds for steam and gases, for water and other liquids are illustrated, among them being the well-known pilot, serpent, sceptre, coolie and other types in general use; jointing materials, corrugated valves, G.G. rings, hoses, etc.

The Phosphor Bronze Co., Ltd., have recently sent us their new catalogue, which sets out all particulars of the specialities of this well-known firm, such as Phosphor Bronze, cast rolled or drawn; Gun metal, ingots and castings; Brass, ingots and castings; White anti-friction metals, and all non-ferrous alloys. Some very interesting information is contained in the booklet, *viz.*, "Foundry points in treating phosphor bronze," "Tables of tests of rolled phosphor bronze," "Tenacity of metals at various temperatures," and "Weight of various rolled metals." Engineers interested will do well to send for a copy and to note the various requirements in which phosphor bronze may be utilized.

NORTH SEA FISHERIES EXHIBITION OF MARINE OIL ENGINES.

THE North Sea Fisheries Exhibition at Yarmouth for marine motors, which opened its doors on the 29th October and closed on November 12th, attracted great interest and its supporters can congratulate themselves on its success. The exhibition was a thoroughly representative one, and among the exhibitors were the following firms: Messrs. Thornycroft & Co., Messrs. Norris & Henty, Messrs. Perman & Co., Messrs. W. Beardmore & Co., and Messrs. James Pollock, Sons & Co. All the engines were at work and those interested had an opportunity of inspecting some of the best-known types of marine oil engines.

The exhibit of Messrs. John I. Thornycroft & Co., Ltd., of Caxton House, Westminster, was a very interesting example of the type of marine oil engine in which they specialize. The set comprised one of their 47 brake horse-power C4 type oil engines mounted up complete with Thornycroft reverse gear driving a propeller in a water tank and working continuously during the period of the exhibition, under conditions which closely approximated to those that exist in the many drifters. The engine is of four cylinders, each 6 in. diameter, and 8 in. stroke. The fuel used is paraffin lamp oil, on which it may be started up by using a single lamp (irrespective of the number of cylinders), to heat the vapourizer to the point at which the fuel is vapourized. When this has been reached the lamp is removed and is not required except to start up again after a stop of some duration. In ordinary manœuvring or even for stops of an hour or so, it is possible to start without again using the lamp, as the vapourizer is designed to retain the heat for a considerable period. As paraffin fuel varies to some extent, a bye-pass is provided so that the heat of the vapourizer may be regulated according to the quality of the fuel used. This is probably the most efficient form of vapourizer yet devised for marine oil engines.

In many cases it has been found advantageous to use petrol for starting. This method enables a start to be made instantaneously without recourse to the use of a lamp. The carburettor has, therefore, double float boxes for paraffin or petrol respectively. The paraffin is turned on and petrol supply cut off by means of a two-way cock when the vapourizer is sufficiently heated by the exhaust gases—a matter of ten or fifteen minutes. The lever used for switching from petrol to paraffin is also used for cutting down the supply of fuel for slow running. Though objection may be raised to the presence of even the small quantity of petrol required, the fact remains that in the numerous sets working on this system no accident has yet occurred and the risk is negligible in an ordinarily good installation. The advantages, beyond that of instantaneous starting are cleanliness, the avoidance of the use of lamp, and the possibility of securing a substantial increase of power when the utmost speed is desired, such as in racing for port with a catch. The speed of the engine in ordinary working condition is about 500 revolutions per minute, but the range of control and consequently of power is such that it may be throttled down to 300 revolutions and still work regularly and efficiently, or accelerated to 800 revolutions for the utmost speed.

The fuel consumption has been proved (by skippers of East Coast boats using this type of engine) to be no more than from 2½ to 2¾ gallons per hour. The average on a run of upwards of 400 miles was registered to be nearer the lower figure. The figure the makers guarantee (following their policy of not under-estimating in such cases) is ·9 pints per b.h.p., which shows a substantial margin over the consumption on service. The ignition is by Bosch high-tension magneto. The high-tension system was adopted by Messrs. Thornycroft on its being shown that it had several advantages over the usual low-tension system, one of which is ease in starting. The magneto is placed on a platform near the top of the crankcase on the front of the engine where it is particularly accessible. A noticeable feature is the strikingly simple form of lubrication. The oil is automatically sucked from the crankcase by a pump which delivers it to a series of nozzles which in turn deliver the oil (in flows which are constantly in full view of the driver) into cups leading to the main bearings and connecting rod bottom ends. A stoppage in any one pipe leading to the bearings, etc., is made evident by an overflow from the cup supplying this pipe, and may be remedied instantly by the insertion of a piece of wire. Also stoppage in one of the nozzles is cleared in the same easy manner; in either case it is unnecessary to stop the engine. There is no excuse for heated bearings. The control of the motor is effected by a single lever which regulates the action of the governor on the throttle valve, and by the provision that is made for advancing and retarding the ignition.

In the matter of accessibility this engine has many points of advantage. Large inspection doors are provided on each side of the crankcase easily and quickly opened, and those on one side are made sufficiently large to allow of withdrawing the piston and connecting rods without lifting the cylinders or otherwise dismantling the engine. The reverse gear is of the Thornycroft epicyclic type providing a direct drive in the ahead position. The propeller is designed specially in each case to suit the boat.

INSTITUTE OF MARINE ENGINEERS.—We have pleasure in noting that the Marquis of Graham has consented to nomination as president-elect of the Institute of Marine Engineers in succession to Sir David Gill. The interest taken by the Marquis in engineering and maritime questions is well known, and we congratulate the Institute.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our Own Correspondent.)

Industrial Deadlock.—These notes are penned at a time when, after eleven weeks have elapsed since the shipyard lock-out notices took effect, there are still no signs of an immediate settlement. On the contrary, negotiations between employers and workmen have reached an absolute deadlock. The employers cannot see their way to entertain the proposal of withdrawing the lock-out notices pending further negotiations, and the Executive of the Boilermakers' Society have entered into communication with "several public gentlemen" with a view to obtaining a large loan in order to carry on the dispute for an indefinite period! In the event of the loan being carried through, the men would be quite willing to enter into an undertaking for repayment by weekly instalments once the lock-out is ended; but the men are emphatic on this point, that "their sole object in doing so is to be the better able to fight against the penalty and other objectionable clauses in the York agreement." From the attitude thus taken up by the men it may be gathered that they are in earnest; but from the reply sent by the joint-secretaries of the Employers' Federation to the secretary of the Boilermakers' Society (pointing out that the lock-out could not be terminated until satisfactory assurances were given that there would be no more sectional stoppages of work), it would appear that they too are in earnest! Both sides seem equally determined not to give in, so that in spite of conferences and proposed outside intermediation, the dispute seems fated to run on into next year, with misery incalculable as the result for the workers, and irrecoverable loss for both sides.

That the questions at stake in the lock-out conflict have been regarded as intensely serious and far-reaching is proved, not only by the stupendous loss the men have sustained, and the loss which the employers have undoubtedly sustained also; but it is emphasised by the fact that quite an unusual amount of fresh and highly important shipping tonnage has been placed in the interim, and awaits the resumption of operations. It would seem quite certain also that the tidal flow of contracts has not yet reached its maximum height. The number of inquiries still in the market is very considerable; and while these may not in every case mature into contracts, the demand is sufficiently solid and real to have tested severely the reality of the arguments used on both sides of the lamentable dispute.

Altogether the amount of fresh shipping tonnage placed with Clyde and other Scottish Shipbuilders since last month's notes were penned runs to about 45000 tons; most of the contributory items consist of steamers of considerable tonnage, and for well-known lines of regular traders. In the notes which follow, general particulars are given of the new contracts booked by individual firms.

Messrs. Russell & Co., shipbuilders, Port Glasgow, have contracted to build for Messrs. Prentice, Service & Henderson, Glasgow, a steamer of 10,000 tons carrying capacity; and for Messrs. Gow, Harrison & Co., shipowners, Glasgow, a steamer of 9000 tons deadweight capacity. For Glasgow owners also—Messrs. Marshall & Dobbie—these well-known Port Glasgow builders, who contrive to have their fourteen building berths almost constantly occupied, have contracted to build a steamer of 7600 tons carrying capacity. Messrs. Russell & Co., not being themselves engineers, are sub-contracting with Greenock and Glasgow firms for the machinery of all the vessels.

Messrs. Wm. Hamilton & Co., shipbuilders, Port Glasgow—a very large portion of whose output this year has consisted of steamers built on the Isherwood longitudinal system, and whose stocks are at present fully occupied—have received an order from Messrs. T. & J. Brocklebank, of Liverpool, for a steamer of 500 ft. in length, and 12,000 tons deadweight, for the Eastern trade, whose construction will also be on the Isherwood principle. This vessel will be the largest ever constructed by Messrs. Hamilton, and her machinery will be supplied by Messrs. David Rowan & Son, engineers, Glasgow.

Messrs. Wm. Simons & Co., Renfrew, who launched on November 7th a powerful twin-screw, bow-well, barge-loading, bucket-dredger, which they have constructed to the order of the Canadian Government, have recently secured, also from the Canadian Government, the contract for a dredger to be employed in connection with the deepening of the harbour at Prince Rupert, the new Pacific terminus of the Grand Trunk Pacific Railway, and at other places in British Columbian waters. There was, it is believed, severe competition by leading American shipbuilding firms who build dredgers, and the tender of the well-known Renfrew firm was £42,000—much below those of American tenderers.

Messrs. Fleming & Ferguson, Phœnix Works, Paisley, have received, from the London Port Authority, an order to construct two dredgers, which, with the order for hopper barges ordered from another firm as elsewhere noted, is said to be only part of the dredging plant which this body has resolved to contract for at this time.

Messrs. Ferguson Bros., Newark Shipbuilding Works, Port Glasgow, have secured the order from the London Port Authority for eight hopper barges, being only part of the work the Authority have at this time to give out.

Messrs. Yarrow & Co., of Scotstoun, have just received an order for a high-speed motor-boat for service at Buenos Ayres. The vessel will be 60 ft. long, by 9 ft. beam, propelled by five sets of internal combustion engines of the Yarrow-Napier design, of approximately 300 total horse-power, designed to give her a speed of 25½ knots.

Messrs. Alley & MacLellan, Polmadie, Glasgow, have booked orders for five vessels of the light-draught description, consisting of a stern wheel steamer of 110 tons; a paddle-ferry-steamer of 100 tons; a stern wheel steamer of 50 tons; a cargo barge of 80 tons; and a steam launch of 10 tons.

Messrs. Bow, McLachlan & Co., Paisley, have presented to the engineering department of Glasgow University a valuable addition to the equipment in the shape of a small steam engine fitted with link motion.

Messrs. Mackie & Thomson, shipbuilders, Govan, have contracted to build four small steamers for one of the new Italian subsidised services. Tenders have been invited by the same owners for four somewhat larger vessels. Mr. W. A. Mackie, of the Govan firm named, has retired from the co-partnery, and is establishing himself as a naval architect, consulting engineer and surveyor, at 50, Wellington Street Glasgow.

Messrs. Scott & Sons, shipbuilders, Bowling, have booked an order from Mr. E. Rabonicich, Glasgow, for a powerful screw tug and salvage steamer for service in South American waters. The machinery for this vessel will be supplied by Messrs. Ross & Duncan, engineers, Govan.

Messrs. MacLaren Bros., yacht builders and motor engineers, Dumbarton, who some time ago completed the last of the ten motor pinnaces required for the fleet of ten torpedo-destroyers built by Messrs. Yarrow & Co., Scotstoun, for the Brazilian Navy, have reason to be gratified with the success of these little craft, which were 18 ft. in length and were propelled by De-Dion motor engines of 8 H.P. These boats have now been thoroughly tested and as a result four more installations of similar power have been ordered by the Brazilian Authorities through Messrs. Yarrow & Co., to be fitted in pulling boats. The engines will have dual ignition, and will be coupled up to MacLaren reversible propellers.

Messrs. The Greenock & Grangemouth Dockyard Company have received an order from Messrs. Paton & Hendry, shipowners, Glasgow, for a steamer of 1200 tons carrying capacity and 11 knots speed, for the coasting and Continental trade. The same firm have received from Messrs. Samuel Huff and Co., Liverpool, an order for a large passenger steamer for their London and Liverpool service. The vessel, which will have accommodation for 100 first-class passengers, will be built at the firm's Grangemouth yard.

New Fairfield Torpedo Destroyers.—The new torpedo-boat destroyer *Cameleon*—the first to be completed of a new type of destroyer which burns oil fuel only—which was launched in June by the Fairfield Shipbuilding and Engineering Company, Govan, has just passed through a series of exhaustive trials on the Clyde, and is now in Fairfield Dock undergoing her finishing touches before being handed over to the Admiralty. The contract speed was 27 knots, but during a part of the full-power trial she steamed at over 30 knots. Two sister-ships—the *Comet* and the *Goldfinch*—also from the Fairfield stocks, are at present being prepared for their trials.

New Clyde Docks.—The Clyde Trustees have now given the necessary Parliamentary notice and plans for the promotion of a Provisional Order for the construction of a large new graving dock, a tidal dock, and other works at Renfrew. They have also authorised the purchase of 1943 square yards of land at Govan for the purpose of making proper access to the proposed new elevating deck vehicular ferry. Between Renfrew and Shieldhall the Clyde Trustees have no less than 405 acres of land, with about two miles of river frontage available for harbour and deck extension. A large part of this land is the old estate of Elderslie, and there is a parliamentary obligation resting on the Trust to the burgh of Renfrew to expend on dock and harbour works on the Elderslie site at least £177,616 over and above the cost of land and equipment before 30th June, 1917, that is seven years hence. Plans of a large graving dock on the site and of associated tidal basin and quayage for commercial purposes, have for some considerable time been prepared by the Engineer of the Trust, and have already been submitted to the Admiralty, who have assured the Committee that the graving dock would be amply suitable for naval ships of the largest type. The proposed tidal dock will be 32 acres in extent and consist of an outer and inner basin, the former being 590 yards in length and 270 yards in width, and the latter 442 yards long and 90 yards in width. The graving dock, which will lead off the eastern side of the outer basin, will be the largest in the world, and be divided so as to serve for docking two vessels of moderate length simultaneously. Under the most favourable conditions, the construction of the new dock and other works at Renfrew will not be accomplished sooner than five years hence.

TYNESIDE AND WEARSIDE.

(From our Own Correspondent.)

Tyneside.

THE enormous gravity to Tyneside of the ten weeks' lock-out period which has elapsed to the date of writing can hardly be over-estimated. One indication revealed in the local press is that during the month of October only three new vessels (two cargo steamers and one tug) have been launched on the Tyne, as against eight in October last year. Under the circumstances, it is not to be wondered at that local interest is being taken in the question in Parliament as to whether the various Admiralty contracts will be completed in the specified time. It is hardly likely that the Admiralty will force the employers' hands by insisting on a termination of the deadlock, but the situation commands interest. Several repair orders have, it has definitely been ascertained, been lost to the Tyne, one going to Liverpool and another to Bristol. Admiralty work delayed includes battleships, torpedo-boat destroyers, a floating dock and a cruiser.

North-East Coast Institution.—At the opening meeting of the present session of the North-East Coast Institution of Engineers and Shipbuilders, the new President, Col. R. S. White, gave two causes for the depression of the past two or three years. One was the amount of tonnage produced through the previous period, which was sufficient to have a large influence on the freight market, and the other was the adoption of a deeper load-line equivalent in carrying power to a year's shipbuilding production.

Apprentices' Strikes.—Tyneside has been visited during the past month with trouble from apprentices in two works. At Messrs. Palmers' Shipbuilding & Iron Co., Ltd., the apprentices struck against a new system of checking time, while at Messrs. Clarke, Chapman & Co., Ltd., Gateshead, as the result of a strike of apprentices on trivial grounds, the firm has established a system of indentures, sums of £5 or £3 (according to department) being forfeited by any apprentice coming out on strike. After some difficulty the majority of the apprentices have signed on under the new terms.

Sir W. G. Armstrong, Whitworth & Co., Ltd.—The civil engineering work in connection with this firm's new shipyard at Walker is proceeding at a good rate. The contractors for the clearing and excavation of the site got their steam navvies on site, and are laying light railways and forming a jetty to facilitate the discharge of the excavated ballast into sea-going hoppers. Electric conveying devices are also, it is understood, to be used. Work has also commenced on the actual excavation, which is being carried on by blasting. Meanwhile, the firm itself is busy. The ordnance department has just despatched from the works one of the largest guns ever built in the North ; an important order has been received from the Leith Dock Commissioners for dock gates and machinery, while on the 18th inst. the launch of H.M.S. *Weymouth*, a second-class cruiser, by Lady Nunburnholme, marked a satisfactory stage in the construction of this vessel.

Messrs. Palmers' Shipbuilding & Iron Co., Ltd.—The most important news concerning this firm during the past month is that the Rt. Hon. Sir Charles McLaren has resigned his chairmanship and that Lord Furness has accepted the position vacated. Work is as much in progress as can be expected in these days, and it is reported that the Ellerman line has placed an order for a steamship with the firm.

Messrs. Parsons' Marine Steam Turbine Co., Ltd.—The satisfactory position of this company was evidenced at the annual meeting, when a dividend at the rate of 10 per cent. per annum was declared and £17,548 2s. 8d. carried forward.

Messrs. Smiths' Dock Co., Ltd.—This firm are now preparing a large dry-dock at the Bull Ring, North Shields, to be 530 feet long by 75 feet wide. The contractors are Messrs. Sir John Aird & Co., the consulting engineer being Mr. J. M. Moncrieff, of Newcastle.

Ericsson Shipping Co., Ltd.—Apparently the working success of the *Monitoria*, built, as will be remembered, with corrugated sides, has been satisfactory, as the directors of the Ericsson Shipping Co., Ltd., intend at an early date to build a duplicate vessel.

Blyth.—Activity in Blyth appears to be good. The Blyth Shipbuilding & Dry Docks Co., Ltd., are busy completing a merchant vessel recently launched for a Glasgow firm interested in the wood trade, while from some recent observations hopes are entertained that Blyth may in the near future have some relations with an Admiralty scheme concerning which enquiries have been made.

Wearside.

Sunderland at present is a pitiable sight, as the pinch of distress which has come upon the wives and families of the men thrown out of work by the boilermakers' lock-out is only too apparent. There appears little hope among the men themselves of an early settlement, as it is known that contracts are being pushed back as far as possible, and that some shipyard owners view the prospect of stagnation till at any rate after Christmas with perfect equanimity.

Sir Edward Grey at Darlington.—Although Darlington is not strictly on Wearside, some words spoken by Sir E. Grey at that place bear so obviously on the present lock-out that they should be quoted, as reported in the local press :—"Order and organization are essential to power, but trade unions can no more carry out their objects without their chosen leaders than shareholders without their general meetings. Without order, discipline, subordination and leaders, trade unions become like a mob, able to wreck, but not to build up."

Minor Naval Base.—The proposal to establish the Wear as a minor naval base is being ventilated locally, Mr. J. Knott, M.P., having put his ideas before the Trade and Commerce Committee of the Sunderland Corporation, who have decided to recommend the Town Council to support the scheme.

Messrs. W. T. Doxford & Sons.—It is reported that this firm has received an order from a Norwegian firm to build two boats, each of 8,000 tons capacity, for a new service between Scandinavia and South Africa and Australia.

Messrs. J. L. Thompson & Sons.—A cargo steamer is, it is reported, on order from this firm from the Bedouin Line.

Sir James Laing & Sons.—A large steamer is on order from Sir James Laing & Sons from the Buenos Aires firm of Messrs. Nicolas Mihanovich, for the South American trade.

Messrs. S. P. Austin & Son, Ltd.—This firm is building a steel vessel for a London firm, to carry about 3,100 tons deadweight, draught about 18 feet.

THE TEES AND HARTLEPOOLS.

(From our Own Correspondent.)

Middlesbrough.

Messrs. Sir Raylton Dixon & Co., Ltd., Cleveland Dockyard, are practically idle owing to the strike. They are reported to be in the running for a steamer for Liverpool owners to indicate about 3,000 I.H.P.

Messrs. W. Harkess & Son are reported to have secured an order for a small coasting steamer, but the report lacks confirmation, owing, no doubt, to the unsettled state of trade.

Messrs. Richardsons, Westgarth & Co. have slackened off very considerably owing to the state of the ship-yards. It is reported there are a few enquiries in the market.

Messrs. Smith's Dry Dock Co. are fairly busy, having several dry-docking and repair contracts on hand, but in their building departments they are also handicapped with the unsettled condition of the labour market.

Stockton and Thornaby.

Messrs. Richardson, Duck & Co. are slack in the yard, but it is reported they have two boats to lay down when the lock-out is ended.

Messrs. Craig, Taylor & Co. are reported to shortly secure a contract for a cargo steamer for local owners, otherwise they are very slack, but are expected to have an order to start with when the lock-out is settled.

Messrs. R. Ropner & Son are slack in the yard. They are, however, reported to have secured a contract from Messrs. Watts, Watts & Co., London, to build two medium-sized cargo steamers, which will be commenced as soon as possible.

Messrs. Blair & Co. keep as busy as the state of the ship-building yards will allow. They are reported to be fairly well off for orders, but at the moment builders are naturally very reticent to state anything connected with new work.

West Hartlepool.

Messrs. W. Gray & Co. have had to slacken down very considerably owing to the lock-out. They, however, are reported to have secured the contract to build a medium-sized cargo steamer of about 5,500 tons deadweight for Messrs. Needham Bros., local owners; also a steamer for Messrs. O. Zuchmann & Co., also of West Hartlepool, and are said to have work in hand for two years.

Messrs. Irvine's Shipbuilding & Dry Dock Co., Harbour Yard, are reported to be finishing a steamer for Messrs. I. A. A. Van Mees & Co., Rotterdam, which has been bought during construction, this being the second boat they have on hand for this firm. They also have been fairly busy in the dry-docking department.

The Central Marine Engine Works of Messrs. W. Gray & Co. are as busy as they can be under the circumstances, and have the contract to supply the engine and boilers for the two steamers previously mentioned to be built by the same firm.

Hartlepool.

Messrs. Irvine's Shipbuilding & Dry Dock Co., Middleton Yard, are reported to have secured the contract to build a large twin-screw meat boat for Liverpool owners, but otherwise are slack in the yard, owing to the lock-out, which is very severe here. They, however, expect to book an order, for late delivery, for a sister ship to the cargo steamer to be built for Messrs. Milburn & Lund, Whitby.

Messrs. Richardsons, Westgarth & Co. have recently delivered the largest set of four evaporators to the *La France*. During a test extending over thirty-six hours, the 180-ton normal capacity evaporators, evaporated as much as 222 tons of water per twenty-four hours, constituting what is considered a record, and which reflects the greatest credit to this enterprising firm. They are reported to have secured the contract to supply the engine and boilers for the new boats to be built by Messrs. Irvine's Shipbuilding & Dry Dock Co., both at the Harbour and Middleton Yards. This includes the engines and boilers of the twin-screw steamer to be built under the superintendence of Messrs. W. Esplen & Sons, Liverpool. These works, however, are on five-eighths time owing to the lock-out.

THE HUMBER AND DISTRICT.

(From our Own Correspondent.)

Efficient Circulation of Water in Steam Boilers.—There was a very large attendance of members at the rooms of the Hull branch of the Marine Engineers' Association on 15th November, when Mr. A. Ross, F.I.C., F.C.S., lectured on the above subject. Mr. A. W. Sommerscales, ex-President, was in the chair, supported by Councillor D. Livingstone, M.E.A., and Vice-President, Mr. Grace. The lecture was of a most highly instructive and interesting character to marine engineers. Mr. Ross, speaking with the experience and knowledge gained by twenty-five years of scientific study and experiment, was able to throw fresh light and ideas upon many debatable points, in the circulating of water and its effects, and particularly upon the course of corrosion in the boiler. Mr. Ross attributed this as being due to the presence of air liberated from the water in the boiler, and described most exhaustive experiments that he had made in proof of this, expressing his personal opinion that galvanic action was not the cause. In the case of combustion chamber stays, the corrosion might be due to heat transmitted by the stay and the bending action due to unequal expansion; at the same time he pointed out that the real cause in many cases was doubtful. After the lecture a demonstration was given with glass models of both the Lancashire and Marine type of boilers, showing the formation of steam-bubble circulation, the effect of a sudden reduction of pressure, and other points connected with the Ross Hotchkiss Circulator. Many questions were asked by the members, and answered fully by Mr. Ross. Councillor Livingstone expressed his high satisfaction with the intellectual treat provided, proposing a vote of thanks to the lecturer and to his agent in Hull, Mr. Harrison, A.M.I.E.E., for making arrangements and his assistance in the demonstration. This was seconded by Vice-President Leetham of Goole, and unanimously carried. The meeting then terminated with a vote of thanks to Mr. Sommerscales for presiding.

Messrs. Earle's Shipbuilding & Engineering Co., Ltd.—This firm is like many other Companies around our coast; the men being locked out, the yard is nearly at a stand-still. Repairs have been completed on several local steamers. The east end of the city is feeling the pinch—shopkeepers, etc.—through the yard being closed down.

North-East Coast Engineering Works have been fairly busy on the s.s. *Elsborg* in the dry dock which has had bilge chocks off, faired and refitted, extensive repairs to bulwarks, and deck and engine-room repairs. The s.s. *Hero* is now in the dry dock undergoing heavy repairs; and No. 5 water-boat; the s.s. *Tees*, has been in for general repairs; and several enquiries for dry docking steamers coming to this port have been made.

Messrs. The Hull Central Dry Dock & Engineering Works, Ltd., have been well employed on the following steamers:—s.s. *Egardian*, new stem, deck and engine repairs; s.s. *Rescue*, bottom damage, several new plates, etc., and deck and engine repairs; s.s. *Edie*, bottom damage, several plates removed, faired, etc.; s.s. *Richard Kelsall*, several new plates, deck and engine repairs; s.s. *Persia*, grounding damage, deck and engine repairs, new winches and derrick gear fitted for heavy work; s.s. *Aislaby*, several new plates in bottom, and other general deck and engine repairs; s.s. *Mineral*, new stem and bow repairs, hull cleaned and painted. Sundry engine-room and deck repairs have also been carried out on the s.s. *Ryhope*, s.s. *Heatherside*, s.s. *Croxdale*, s.s. *Madeline*, s.s. *Westmoor*, s.s. *Dundee*, s.s. *Imperial*, s.s. *Douglas* now in dry dock.

Messrs. Amos & Smith, engineers, Albert Dock Works, have not contracted for any new work, through the lock-out, but have been kept fairly busy with ship and engine repairs; also their branch shop at Alexandra Dock has had a fair amount of repairs during the month.

Messrs. Woodall & Co., engineers and boilermakers, have had repairs on eight steamers during the month, both in engine-room and stokehold. Deck orders for heavy purchase blocks have kept the works fairly busy, together with a number of orders from several Corporations and Railways for forgings. The Company has work in hand up to Christmas.

Messrs. Cooper & Co., Neptune Engine Works, are fairly busy with repair work on several large steamers, and have

also booked many orders from foreigners for their propellers. The branch shop situated at Alexandra Dock has been also kept well employed. The firm's two dry docks in the old harbour have been well employed with small craft and coasting steamers.

Messrs. Cochran & Sons, shipbuilders, Selby, have booked a fairly large number of trawlers for Hull and Grimsby owners, but owing to the lock-out of boilermakers, work is at a stand-still.

Messrs. Cook, Welton & Gemmel, shipbuilders, Beverley.—This firm has been fortunate in securing several orders for trawlers, but the lock-out makes things at a stand-still.

Messrs. C. D. Holmes & Co., engineers and boilermakers, have booked several sets of engines, boilers and deck machinery for Hull and Grimsby owners, but unfortunately the shipbuilders cannot get on with the work through the lock-out of the boilermakers. The branch shop at the Alexandra Dock has been fairly busy with repairs on several large steamers.

Mr. Thomas Tate, engineer and boilermaker, has had a fair month on several coasting-steamers for engine and deck repairs, also work on several oil mills.

SOUTH OF ENGLAND AND ISLE OF WIGHT.

(From our Own Correspondent.)

Dues at Southampton.—At the meeting of the Southampton Harbour Board last month it was decided to approve the draft bill embodying the clauses asking for Parliamentary power to charge differential dues according to the draught. The present dues are 1d. per ton, and it is not proposed to increase this for vessels drawing under 30 ft. At present Southampton is one of the cheapest ports in the United Kingdom, and even if the increased dues were enforced in the case say of a vessel drawing 35 ft. of water, the total dues paid by the vessel at this port would not amount to as much as she would have to pay at Cherbourg for pilotage alone. It was decided to dredge the channel to a depth of 35 ft., and the cost of this will amount to about £80,000. Another question which arose was the widening of the channel. At present the width is 600 ft., and it was anticipated that this would have to be increased up to at least 1,000 ft., which would involve the expenditure of £150,000, besides extra cost in maintenance. By the terms of the Bill it is made clear that the ships which make this extraordinary expense necessary will be called upon to provide the money to make and maintain the necessary channel.

Messrs. J. Samuel White & Co., Ltd., East Cowes, I. of W.—H.M.S. *Redpole*, torpedo-boat destroyer, 1909 programme, ran satisfactory preliminary trials last month, and then proceeded to Sheerness to complete her official trials. H.M.S. *Ruby*, the third vessel of the same class, was launched on the 4th of last month. This vessel, together with the *Redpole* and *Rifleman*, have all been put afloat this year. During the last month a motor pilot-launch for the Madras Port Trust was completed and despatched to her destination. Work is now proceeding on various naval steamboats for the British Admiralty and others.

Messrs. Simpson, Strickland & Co., Ltd., Dartmouth, S. Devon, have a large amount of work in hand, and are well employed in all departments. They have six steamboats in hand for the British Admiralty; a 30-ft. launch for a mail steamer building in the North; four boats for a yacht; a 51-ft. and a 32-ft. steel launch for abroad; and a 22-ft. yacht's launch, in addition to various sets of machinery. Recently they have delivered a very fine 30-ft. steam launch for the Duc de Valencay's s.y. *Sagitta*, and a 43-ft. launch for the India Office, and a 45-ft. launch with a very high speed for a member of the Siamese Royal House. During last month several repair jobs have been carried out, including a large amount of work on the steamer *Italie*, outward bound to Bombay.

Messrs. Day, Summers & Co., Ltd., Northam Iron Works, Southampton.—The s.s. *Don Carlos* recently built for the Messrs. Leibig Meat Co. proved herself a good sea-boat during her passage to South America, and has fulfilled the owners' requirements in every way. The instructional turrets for Chatham, Devonport and Eastney barracks are in course of erection, and shipment will be made next month. The p.s. *Lord Elgin* is on the slip undergoing conversion from passenger to cargo vessel. The s.s. *Olive* was on the slip last month undergoing extensive repairs, and a large amount of work was carried out on the s.ys. *Niagara* and *Catania*. The coal elevator despatched to the London Docks in the autumn continues to do good work and is regularly handling 100 tons of coal per hour with ease.

Messrs. John I. Thornycroft & Co., Ltd., Southampton.—H.M. Ships *Larne*, *Lyra*, *Martin* and *Minstrel*.—The *Larne* has been handed over to the Admiralty, and the *Lyra* will follow early this month. The *Martin* and *Minstrel* are making good progress, and the *Martin* will be launched early this month. H.M. Ships *Acheron* and *Ariel*.—These vessels are in frame, and the decks will be completed about the middle of the month. Fire-float *Gamma*.—The motors were fitted in November, and work is now proceeding on the pumping machinery. P.s. *Arabia*.—This vessel was being dismantled last month, and will be shipped in sections early this month to Egypt. *Rocklight of London*.—The hull of this vessel has been water-tested, and the motors are now installed. 56 ft. barge for Portsmouth.—The framing of this barge is completed, and the shell plating, etc., is well forward. Launches.—The first and second of the 63-ft. motor-boats for Bagdad successfully completed their official trials last month, each exceeding the contract speed by about 1½ knots. The first two have been shipped, and it is expected that the third will follow before the end of the year, also the twin-screw steam launch for the Amazon will be completed, and shipped this month. New Orders.—An order has been received from the Governor-General of Bagdad for a stern-wheel passenger-steamer 120 ft. long, to be capable of a speed of 10 knots on 21 in. draught. Repair Work.—The repair department continue to be fully occupied, vessels in hand being the s.s. *Hvalen*, s.ys. *Rovenska*, *Liberty*, *Maund* and *Erin*. Lattice-bridges for H.M. Ships *Vernon I.* and *III.* and various troopships.

THAMES.

(From our Own Correspondent.)

The New Port Rates on Goods.—These rates have come into operation, and a new staff is engaged on the work, answering enquiries and furnishing particulars as to the course of procedure to be adopted. Experts from Liverpool Docks have, it is said, been called in to assist, and this seems likely, the Mersey having always been put forward as the model authority. From a return recently published we find the staff at the different docks numbers 11,000 and takes £1,250,000 in wages and salaries. The goods passing through the docks in a year is valued at £100,000,000. As a result of the first year's working of the new authority, there is a surplus of £57,929. The profits from the river and docks were £742,720, and from warehouses, £284,006. Administration expenses amounted to £892,347, and interest absorbed £806,821, leaving the balance as above stated. The tonnage cleared was 35,151,799 tons, or an increase on 1908 of 1,383,200 tons. The developments foreshadowed are put down as amounting to £735,611, distributed over the docks as follows: London and St. Katharines, £90,560; East and West India, £150,240; Victoria and Albert, £265,652; Tilbury, £86,448; Surrey Commercial, £89,884; Milwall, £61,827; and these are for immediate necessities only. As regards the river, the following works are to be proceeded with:—Albert to Greenland entrance to Surrey Commercial Dock, a channel 500 ft. wide by 20 ft. deep at low water spring tides. Greenland entrance to Thames Tunnel, a channel 500 ft. wide and 16 ft. deep. Thames Tunnel to Tower Bridge, 500 ft. wide and 14 ft. deep; and Tower Bridge to London Bridge, 450 ft. wide and 14 ft. deep. It is seen, therefore, the Authority is beginning to act. Meantime, that the Authority is imposing on imported goods 65 per cent. of the maximum and on exported goods 25 per cent. is causing some resentment on the part of merchants and strong protests against these figures. These payments came into operation on November 1st last.

Shipbuilding.—The work at the Thames Shipbuilding and Ironworks Co. proceeds apace. The first Thames "Dreadnought" has night and day shifts working on her to get finished to time, and the rate of progress is sufficient to justify the certainty of this being accomplished. An old-time and well-known shipbuilding firm, Messrs. R. & H. Green, of Blackwall, have amalgamated with Messrs. Silley, Weir and

Co., Ltd., and this probably points to further development in the ship-repairing industry with which the former firm has been associated with in recent years.

Shipping Companies.—The new service direct to East Africa is proceeding smoothly, and the third vessel, the *Ghoorka*, sailed on November 3rd from London. Another new vessel has left, the *Intaba*, the latest addition to Messrs. J. T. Rennie & Co.'s fleet to Natal and East Africa. This vessel is some 4,400 tons register, and is constructed on the Isherwood principle, with holds entirely free of obstruction. The ship is fitted with the latest form of wireless telegraphy, giving a range of 400 miles. The New Zealand shipping Co.'s new vessel, *Roturia*, sailed for Australia. This ship, the second of her class, is fitted with combined reciprocating and low pressure turbines, and is expected to maintain a speed of 16 knots.

Chamber of Shipping.—It is officially announced that the Hon. Noel Farren has been elected to the position of Secretary of this Chamber, to take effect at the end of the year, when Mr. W. H. Cooke retires. Mr. Farrer has for some years been associated with the Board of Trade, and was largely engaged with the schemes which culminated in the present Port of London Authority as we know it now, and therefore possesses a knowledge of maritime matters.

Thames Bridge.—On the matter of the new St. Paul's Bridge, the Corporation and County Council have come to agreement, so it may be expected that matters in this direction will proceed somewhat rapidly, the question of trams being the cause of dispute. In view of the contribution of £300,000 by the County Council, this body have decided not to proceed with the reconstruction of Lambeth Bridge.

Seamen at St. Pauls'.—The annual service has been held at the Cathedral, and representatives of our seafaring population, not only of British, but other nationalities, were present, the seven years since it was first held having, of course, served to heighten the interest of the event. Besides the Hon. Sec., Lieut.-Col. Willis, late Royal Marines, there were present Lord Gorell, Sir E. Fremantle, Sir N. Bowden Smith, Sir Digby Morant, and Sir George Vyvyan, the Deputy Master of the Trinity House. Representatives were present from all the Societies allied to shipping in any form, and Cadets from Colleges connected therewith, totalling the congregation up to 4,000, apart from the members of the public in distant seats. The service was a most impressive one, with a special choir, and Sir Geo. C. Martin at the organ.

MERSEY AND MANCHESTER SHIP CANAL.

(From our Own Correspondent.)

IT is pleasant to note that, as predicted in our last report for the Mersey District, the placing of new work by the British Admiralty has been fulfilled. Repair and other work has been fairly brisk in those establishments not affected by the lock-out. Work meanwhile is still somewhat restricted in the works belonging to the Federation, but it is sincerely hoped that this will soon be a thing of the past.

Messrs. Cammell, Laird & Co.—This firm have now every prospect of an extended busy period before them, and with the splendid facilities both in works and docks, which are always being extended, it is confidently expected that this port will enhance its fine reputation for the highest class of merchant and naval work. The *Highland Brae* ran a very successful trial on November 1st. This, the second of these fine vessels building for the Nelson Line, is one of the fleet of nine vessels building for the River Plate trade, and is evidence of the large additions now being made to the tonnage of our various steamship lines. Mr. Wm. Boyd, Managing Director of Messrs. Cammell, Laird's, met with a serious accident during the trial, falling some 25 or 30 ft. We are pleased to be able to state that he escaped with only slight injury and is now making a rapid recovery. The *Highland Brae* sailed from the Mersey on November 19th, in the Company's regular River Plate service. Her two sister-ships, *Highland Loch* and *Highland Piper* are making good progress and are nearing the launching stage. The Argentine Destroyers are well advanced with their plating, while the turbine machinery and boilers are nearly complete. Besides the two British destroyers *Lapwing* and *Lizard* an order for two more similar vessels may be placed; these vessels are of the improved Acorn class and will have a speed of 29 knots and will burn oil fuel. It is hoped and also rumoured that this firm may secure its share of the new battleship work recently tendered for. It would be very satisfactory for Birkenhead if such proves to be the case, since this yard has been so long noted for its Admiralty vessels, including battleships. The floating dock is making progress, and with the hoped-for termination of the lock-out, will advance rapidly. The boats for the Amazon are being plated. An order for twelve barge frames is being executed for the Ceylon Wharfage Company of Colombo. These frames are being shipped to their destination on completion, and on arrival out they are built up with teak and made into strong barges. With their usual consideration for their employees, this firm, while suffering from the lock-out, are making efforts to continue employment for as large a number of men in other departments as possible. To this end the works were put on short time on November 17th. Messrs. Cammell, Laird's Sheffield works have recently received large orders, and a busy time is expected. This has had the result of causing a demand for both the preference and ordinary shares of this firm. The steamer *Laura* has been in graving dock for repair and overhaul. The second of the four boats for the Amazon was launched on November 19th. She was named the *Ceara*, and will sail for Para within the next six weeks. An important order for a second-class cruiser of the improved town class was recently secured by this firm. This vessel will be built and engined at the new works at Tranmere Bay. The utmost secrecy is being observed in the construction and design of this vessel.

Messrs. David Rollo & Sons.—The extensive works of this firm have been exceptionally busy for some time past. The brass and iron foundries are turning out record weights, while the boiler-shop, amongst other contracts, has a boiler installation for the colonies, a marine boiler for the African Steamship Co. A number of patent vertical donkey-boilers are also in hand. The Anglo-American Oil Co.'s steamer *Appachee* has been in for overhaul and repairs; the *Sullust* has had double-bottom ballast tanks renewed, while the *Harmodius* and *Laxoleine* have had bottom damage repairs.

The International Vanadium Co., Ltd.—The works of this Company at Garston have been now fully occupied for some time. Work has been conducted both day and night in order to fill the large contracts which have been secured in England and abroad. Very large orders have recently been given for Ferro-Vanadium, the use of which is extending very rapidly all over the world. The Company have recently completed several extensions to their works, now enabling them to turn out a very large production of the highest grade of alloy. This Company are also at the present time producers on a large scale of Ferro-Titanium, which is growing in favour amongst manufacturers of steel products, and particularly of rails.

Messrs. H. & C. Grayson.—This firm have always a large variety of work on hand in their various yards, and keep well abreast of the times. Mr. H. M. Grayson has for some time past looked after the Merseyside interest of Messrs. Silley, Weir & Co., Ltd., of Millwall, and Albert Docks, London, who have recently amalgamated with Messrs. R. & H. Green, of Blackwall. On November 9th the second of the C.P.R. tenders, the *Gopher*, ran her trials. The sister-boat *Musquash* passed through a successful trial towards the end of October. Amongst others on the trial with Mr. H. M. Grayson, were Capt. Mowatt, Marine Superintendent C.P.R., and Mr. G. H. Butterworth, Superintendent Engineer C.P.R. The builders of the engines, Messrs. Crabtree, were also represented. The trials were conducted in the Crosby channel and were very satisfactory. The dimensions of these boats are:—Length, 100 ft.; breadth, 23 ft.; depth, 13 ft. 1 in., and are built to Lloyd's 100 A1 class. There is a cross-bunker between the engines and boilers. These engines are of the triple-expansion type, with cylinders 16 in., 26 in. and 42 in., stroke 27 in. One boiler is of 14 ft. 6 in. diameter and 10 ft. 6 in. long. These vessels are very powerful in view of the increase of the size of the liners. The steamers *Cornubia* and *Alma* have been in the Canning Graving Dock. At Birkenhead the *Latchford* has had stern repairs, the tug *Flying Kestrel* alterations and repairs, also the steamer *Arnfrid*. The committee of the training-ship *Indefatigable* have placed the sea-going tender *James S. Bibby* in Messrs.

Grayson's hands for repairs, this vessel having been built by this firm. The Dock Board's dredger *Walter Glynn* is in for damage repairs, due to her recent capsize off the Seaforth Battery. The steamers *Locksley Hall* and *Knight Errant* have also been in for repairs.

The Mersey Docks and Harbour Board.—For the twelve months ending July, 1910, a total of 24,961 vessels paid dues, this being 162 more than last year. The total tonnage was 16,654,071. The rates and dues on vessels and goods was £1,361,694, a decrease of about £1,896. In the year 1858 the total tonnage was 4,441,943 and the receipts less than half a million. Dredging the Bar and Revetment cost £109,480. The total value of the Mersey Dock Estate, works, lands, etc., amounts to £31,935,949, the sinking fund being £4,167,280.

Messrs. Lever Bros., Port Sunlight.—This firm are the owners of a somewhat unique vessel, *viz.*, the barque *Rendova*, of 1,295 tons reg. She is built specially for the carriage of oil in bulk and has a longitudinal bulkhead extending fore and aft and nine transverse ditto, thus giving the ship ten oil tanks, two cofferdams, and two cargo hatches. A large donkey-boiler is placed under the fore part of the poop, this being used to work two sets of pumps capable of discharging 300 tons of oil per hour. The *Rendova* has recently reached Liverpool with a cargo of 2,140 tons of cocoanut oil from Sydney. The passage took 176 days *via* Cape Horn.

White Star Line.—Mr. Ismay has recently been in Montreal in connection with this Company's Canadian service. The *Laurentic* and *Megantic* have been so successful that it is expected that two more vessels of larger size will be put on the route shortly to give a weekly fast service. Mr. Dargue is expected to join the Liverpool staff, while his former post at Naples will be filled by Mr. S. E. Cruse.

The Cunard Line.—It is understood that this Company have asked Messrs. John Brown, Ltd., of Clydebank, and Messrs. Swan, Hunter & Wigham Richardson, of Wallsend-on-Tyne, to specify for the largest passenger vessel in the world. In this connection the Clyde Trust are to apply to Parliament for power to construct a new tidal dock of 32 acres and a new graving dock 1,000 feet long and 110 feet broad, which will be the largest of its kind in Great Britain. This Line's coal contract has just been placed with the Denaby & Cadeby Main Collieries; 5,000 tons per week of large steam nuts and pea nuts will be required. This contract is expected to ensure full work at the collieries.

NORTH-WEST OF ENGLAND.

(From our Own Correspondent.)

A Gigantic Order.—Messrs. Vickers, Sons & Maxim have secured probably the largest order ever given out to any shipbuilding firm in the world. They have been commissioned by the Imperial Japanese Government to build a battleship-cruiser of from 27,000 to 28,000 tons displacement, at a cost of about £2,500,000. This is a much larger vessel than the battleship-cruiser now building at Barrow for His Majesty's Navy, and when the latter order was placed at Barrow, about a year ago, it was looked upon as the biggest job ever given out to private builders by the British Admiralty. The order has been placed with the Barrow builders by the Imperial Japanese Admiralty as a mark of their high appreciation of the work done by British shipbuilders for the Eastern Power, and this may be accepted by the builders as a proof of the great satisfaction the Messrs. Vickers' Company gave in the orders executed at the Barrow yard for the Japanese navy. Admiral Togo's ship during the war was the Barrow-built battleship *Mikasa*, which gave an exceedingly good account of herself, and after she sank in a Japanese harbour through negligence in opening one of the sea-cocks, she was floated again some months later on, and so confident were they of the ship's capabilities that steam was at once got up and she steamed to a place of safety by means of her own engines. Since then the Vickers' firm built for the Japanese navy the battleship *Katori*, two submarines, and several other incidental fittings for various types of battleships. For many years past Japanese officials, and Japanese workmen, have been engaged at the Barrow works in connection with orders which have been passing through. The intimation has been publicly made that the conditions under which the battleship-cruiser have to be built are those of absolute secrecy as to all the details of her construction. It is believed she will be about 750 ft. long, or 50 ft. longer than the *Lion* and the *Princess Royal*. It is evident the Japanese Government intend to keep in the forefront of naval construction. In their newest vessel they have gone one better than the British Admiralty, and doubtless later on we shall hear that ships have been designed by ourselves that are to outvie anything afloat or in course of construction. Such is the trend of modern warship design. It goes without saying that this order, with other very important work in hand at the Barrow yard, will make this establishment very busy for some time to come.

Another British Order.—The Admiralty have placed the order with the Messrs. Vickers' Company for the construction of a salvage steamer in connection with the British submarine flotilla, which has been almost wholly built by this Company. It is thought probable that a sister-ship will be needed, seeing that the submarines now afloat are stationed at different ports on the coast line.

New Enterprise.—The Messrs. Vickers' Company have determined to construct a new deep-water wharf on the Barrow side of Walney Channel at which the largest vessels yet designed or in future to be designed can be fitted up ready for service. The dockgates at Barrow admit vessels up to a width of 100 ft., but modern construction is going beyond this width, and hence the necessity of either putting a new and wider entrance into the docks at Barrow or providing a channel wharf. The latter course is to be adopted, and the berth will be dredged to a depth of about 30 ft. at low water. It is also probable that the channel from this berth out to sea, a distance of about four miles, will have to be dredged so as to ensure the safe ingress and egress of the largest vessels at high water, and so also to ensure the creation of Barrow into a deep-water port. This is a big enterprise, but it is regarded as essential in the interests of the Vickers' Company and the growing size of modern ships of war and modern mercantile steamers.

Work in Hand.—Messrs. The Vickers' Company have now their hands well filled with work, and yet they are always negotiating for new business. They have now a British battleship-cruiser in course of construction, a Japanese battleship-cruiser, two of the Town class of cruisers, a submarine salvage steamer, and several submarines for the British Admiralty, a Chinese cruiser, and other smaller incidentals of shipbuilding. In the engine-works they are more crowded with big and small orders than they ever were. They are looking forward to many years of brisk trade.

Maryport.—A coasting steamer, launched by Mr. William Walker at Maryport in October, has been sold to Messrs. T. W. Ward, Ltd., Sheffield. She is steel built, of the highest class at Lloyd's, and is 430 tons, 125 ft. long, 25 ft. broad, and 11 ft. 5 in. deep. She will be engined at Glasgow, by Messrs. Ritchie.

Hæmatites.—The demand for hæmatite iron has fallen off considerably, and prices are lower at 65/6 for Mixed Bessemer Nos. nett f.o.b.

Shipping.—Shipping is only moderately employed. Freights are not satisfactory. Coal and coke in smaller consumption.

THE TURIN EXHIBITION.—The Board of Trade Committee appointed to consider the advantages to be derived by British manufacturers from exhibitions, to advise and encourage exhibitors, we note has confidence in the promotion of the Turin Exhibition, and there is a likelihood that Britain will be well represented. The unfortunate fires, which created not only damage but general uneasiness at the Brussels Exhibition, as probably due to malevolence, have been instrumental in rousing the special attention of the authorities in order to safeguard the interests of exhibitors and visitors alike by making special provisions for prevention and more adequate means to cope with fires, should any occur. We are to be well provided with exhibitions next year, as in addition to those at Turin, Shepherd's Bush and the Crystal Palace, that at Glasgow will probably prove very attractive.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES English.

Endcliffe. On October 19th Mr. William Walker, of Maryport, launched a steel screw steamer *Endcliffe* to the order of Messrs. Thomas W. Ward, Ltd., Sheffield. The dimensions are :—Length between perpendiculars, 135 ft. ; breadth, moulded, 25 ft. ; depth moulded, 11 ft. 5 in. She will be fitted with C.S.C. engines by Mr. James Ritchie, Glenavon Engine Works, Partick, Glasgow, having cylinders 17 in. and 36 in. by 24 in. stroke ; Boiler 12 ft. 6 in. diameter by 9 ft. 6 in. long by 130 lbs. working pressure. The vessel is built to the highest class at Lloyd's, and is intended for the general coasting trade.

Sir Arthur.—On November 1st, there was launched from the shipbuilding and repairing establishment of Messrs. S. P. Austin & Son, Ltd., the steel screw steamer *Sir Arthur*, of 3,100 tons deadweight capacity, to the order of Messrs. Wm. Cory & Son, Limited, of London, and the twenty-first vessel constructed for the same owners. She will be classed 100 A1 in Lloyd's Register, under special survey, and the arrangement of water ballast, hatchways and auxiliary machinery, also accommodations, are adapted to the owner's special requirements for their own coal trade. The machinery will be supplied by Messrs. George Clark, Ltd. A Cochran (Annan) donkey boiler with patent seamless furnace has been supplied and fitted.

Bury.—On November 3rd, there was launched at Hull the steamer *Bury*, which has been built to the order of the Great Central Railway Company for its passenger and cargo service between Grimsby and Hamburg. The principal dimensions are :—Length, 265 ft. ; breadth, 36 ft. extreme ; depth, 18 ft. 6 in. moulded. She is of one-deck type, with poop, long bridge and topgallant forecastle, and has ample accommodation for passengers. The machinery will consist of a set of triple-expansion surface-condensing engines, having cylinders 22, 35 and 60 inches by 42 inch stroke, indicating about 2,000 horse-power. Steam will be supplied by two large cylindrical boilers, working at a steam pressure of 180 lb. per square inch.

Watermouth.—On November 15th, Messrs. Richardson, Duck & Co. launched from their yard a steel screw steamer of the following dimensions :—Length overall, 393 ft. 6 in. ; breadth extreme, 50 ft. ; depth moulded, 28 ft. 11 in., with a deadweight carrying capacity of 7,500 tons. This vessel, which has been built to the order of Messrs. Anning Brothers, of Cardiff, will class 100 A1 in Lloyd's Register, and has been built under special survey. She is a single-deck steamer with wide spaced channel frames. Steel centre division is fitted in holds, in which there are no beams nor quarter pillars. Vessel has cargo poop, bridge amidships, and topgallant forecastle, with very large hatches to expedite the loading and discharging. Special accommodation for captain, officers and engineers is provided in steel deckhouses on bridge deck, petty officers and apprentices being berthed under bridge at after end, and crew in topgallant forecastle. A cellular double bottom for water ballast is fitted throughout except under boilers. Vessel has also peak tanks, and equipment includes seven steam winches, exhausting into contraflo winch condenser ; large horizontal multitubular donkey boiler, fourteen derricks, steam windlass with quick warping ends, steam-steering gear, etc., etc. The engines, by Messrs. Blair & Co., Ltd., have cylinders 25 in., 42 in., 68 in. by 45 in. stroke, steam being supplied by two extra large single-ended boilers, having a working pressure of 180 lbs., and fitted with Howden's forced draught.

Wearbridge.—On November 17th, Messrs. The Northumberland Shipbuilding Company, Ltd., launched from their yard at Howdon-on-Tyne a finely-moulded steamer built to the order of Messrs. Crosby, Magee & Co., of West Hartlepool, for Messrs. The North of England Steamship Company, Ltd. The vessel is 371 ft. long by 49 ft. beam by 29 ft. 4½ in. deep, and has been built under special survey to the highest class at Lloyd's. She is fitted with long bridge, long poop, topgallant forecastle, the accommodation, which is very ample, being placed in steel houses on bridge deck. Special attention has been paid to the loading and discharging gear, and a complete outfit for the rapid handling of cargoes arranged for, consisting of eight steam winches by Messrs. Clarke, Chapman & Co., Ltd., Gateshead-on-Tyne, a large number of cargo derricks, and steam windlass by Messrs. Emerson, Walker & Thompson Bros. She is fitted with the usual water ballast arrangements for light passages. The machinery will be supplied by Messrs. Richardsons, Westgarth & Co., Ltd., Sunderland, consisting of engines with cylinders 25 in., 41 in. and 69 in. by 48 in. stroke, three boilers with 180 lbs. pressure. The vessel will carry about 7,200 tons on a light draught and steam about 10 knots loaded at sea.

Anticosti.—On November 17th, Messrs. Short Brothers, Ltd., launched from their shipyard, Pallion, Sunderland, the s.s. *Anticosti*, built to the order of Messrs. E. F. & W. Roberts, of Liverpool. This steamer has been specially designed to be chartered for carrying coal for the Dominion Coal and Iron Co., of Sydney, C.B., with arrangements so that the cargo and bunkers will be entirely self-trimming. She is built on the Isherwood system to take Lloyd's highest class, and her leading dimensions are :—Length, 389 ft. ; beam, 52 ft. ; and depth moulded 30 ft. 9 in. Water ballast is carried throughout the double bottom, in fore and after peaks, and in wing tanks, the full length of holds and engine spaces amounting in all, to about 2,500 tons. Ten large cargo hatches are fitted with steel hinged covers. The discharging arrangements are very complete, six derricks being fitted to each mast and eight Samson posts with twelve derricks, worked by eleven steam winches. Accommodation for officers, with saloon neatly panelled in oak, is fitted in steel house on forward bridge, with captain's room and office above. The chart and wheel-house is placed on top of captain's house, with flying bridges on tops of saloon and captain's house. The engineers are berthed in houses alongside of casing, and crew in topgallant forecastle. A sanitary service is installed throughout the officers' and engineers' accommodation. Steam windlass, steam-steering gear in engineroom controlled from wheelhouse and connected to quadrant by rods and chains, and steam ash hoist will be supplied. The propelling machinery will be fitted by Messrs. The North-Eastern Marine Engineering Co., Ltd., Sunderland, and consists of engines with cylinders 26 in., 44 in. and 73 in. diameter and a stroke of 48 in., driven by three large multitubular boilers, working at 180 lbs. pressure, and fitted with Howden's system of forced draught. To enable the large quantity of water-ballast to be expeditiously handled, two large ballast pumps are fitted, capable of discharging 300 tons per hour. Whilst under construction, the hull and engines have been under the supervision of Messrs. Atkinson & Young, of Liverpool, and Captain Davies, of New Quay, the owners' superintendent.

LAUNCHES—Scotch.

Strathardle.—On October 24th, Messrs. Archd. McMillan and Son, Ltd., Dumbarton, launched the steel screw steamer *Strathardle*, the last of four vessels ordered from them by Messrs. Burrell & Son, Glasgow. The vessel is of the following dimensions :—Length, 390 ft. ; breadth, 52 ft. 3 in. ; depth, 28 ft. She is constructed with clear holds, and large water-ballast capacity is provided in cellular double bottom, aft peak and in a deep tank amidships. The appliances for the rapid handling of cargo include twelve derricks and ten powerful steam winches. The machinery is being supplied by Messrs. David Rowan & Co., Glasgow, and both vessel and machinery have been built under the special survey of the British Corporation Registry for their highest class. The steamer has been built under the supervision of Mr. James C. Stewart, the owners' superintendent.

Cabral.—On October 27th, there was launched from the yard of Messrs. Napier & Miller, Ltd., Old Kilpatrick, the steel screw steamer *Cabral*, built to the order of Messrs. Jas. Pollock, Sons & Co., Ltd., London. The dimensions of the vessel are :—Length, 174 ft. 6 in. ; breadth, 35 ft. ; depth, 9 ft. 3 in., with a gross tonnage of about 480 tons, built under the rules of Lloyd's Register for service on the River Amazon. The vessel is rigged as a two-masted schooner, has main promenade and awning decks. Accommodation for forty first-class passengers has been provided amidships in state-rooms on promenade deck. The captain and officers are berthed in house on bridge, accommodation for engineers being provided for on the main deck. The vessel, which is intended for the passenger and cargo trade on the river Amazon, has been fitted with refrigerating plant with cold storage chamber, electric light, steam windlass, steam-steering gear and two steam winches. The machinery is being

supplied by Messrs. Miller & Macfie, Ltd., Glasgow, and consists of compound engines, and one large main boiler and donkey boiler. During construction the vessel has been under the supervision of Mr. Murray, the owners' representative.

Tinto.—On November 3rd, there was launched at Dundee a steel screw cargo steamer, which has been built to the order of Messrs. Thos. Wilson, Sons & Co. (Limited), Hull. The vessel is specially designed for the general cargo trade. She is 290 feet long, and has four steam winches and double derricks for the rapid handling of cargo. Water ballast is provided in the fore-and-after peaks and in the cellular double bottom under the engines and after-hold. The vessel will be fitted with two boilers and triple-expansion engines of good power.

Bucket Dredger.—On November 7th, Messrs. Wm. Simons and Co., Ltd., of Renfrew, launched from their yard, complete and ready for work, a powerful twin-screw bow-well barge-loading bucket dredger, which they have constructed to the order of the Canadian Government, and which has been under Lloyd's rules for their A1 steel dredger class. The dredger is fitted with two sets of compound surface-condensing engines, each driving its own propeller, steam being supplied by two steel multitubular boilers constructed to Lloyd's requirements for 120 lbs. working pressure. Suitable clutches are provided for engaging to and from the propelling and dredging machinery. The dredging wheel gearing is of very strong and massive construction. Each set of engines is arranged to give two speeds of buckets, so that either set of engines is available for driving the dredging gear irrespective of whether the material is of a hard or soft nature, a constant piston-speed being always maintained. The bucket ladder which is constructed of the best form of girder work in accordance with the builders' latest practice, is designed for dredging her own flotation and to a depth of 50 feet below water-level. The bucket dredging capacity will be from 1,000 to 1,200 tons per hour. Steam hoist gear, fitted with the builders' friction arrangement, is provided for controlling the bucket ladder. The engine-room fittings include all the latest appliances for a vessel of this type. Spacious and very comfortable quarters are provided for the officers on a special deck aft, and comfortable and commodious quarters are provided forward for the crew. The vessel is fitted with a complete electric light installation, including search-light at bow, so that the vessel can work day and night. Refrigerating plant for cold storage is also fitted up on board.

LAUNCHES—Irish.

Ascanius.—On October 29th, Messrs. Workman, Clark and Co., Ltd., of Belfast, launched from their North Yard the second of three vessels being built and engined by them for the well-known Blue Funnel Line, owned by Messrs. Alfred Holt & Co., Liverpool. The new vessel is named *Ascanius*, and like her sister vessels, the *Æneas*, which is now ready for commission, and the *Anchises*, which will be launched shortly, she is intended for a new service of steamers which this well-known firm are establishing between Great Britain and Australia. The *Ascanius* is 509 ft. in length, with a gross tonnage of about 10,050, and complies with the requirements of the British Board of Trade for a first-class passenger certificate. In designing the vessel special attention has been given to the arrangement of the passenger accommodation, which is arranged for first-class only, and occupies the midship portion of three decks. The private state-rooms throughout are all exceptionally large and airy, and the public rooms include a handsome and well-lighted dining saloon, a comfortable nursery for the children, a drawing-room, and a large smoke-room. A complete installation of electrically-driven fans has been installed. The sanitary arrangements throughout are of the most modern character, while the galleys and pantries will be replete with all the latest culinary appliances. Other features arranged for the convenience of the passengers include a laundry with modern machinery, a hairdresser's shop, and a baggage and parcel room, while, by an installation of wireless telegraphy, the vessel will be able to keep in touch with passing vessels. The cargo space is divided into six spacious holds, free of obstruction and capable of receiving the largest type of consignments. One of these holds, together with the after 'tween decks, has been carefully insulated and prepared for the carriage of frozen meat, fruit and dairy produce. For the preservation of this cargo, and the stewards' perishable stores, an extensive plant of refrigerating machinery on the carbonic anhydride system has been arranged. For the speedy loading and discharging of the vessel, two and three steam winches with the necessary derricks are provided at each of the hatchways, which have been made extra large. The propelling machinery includes two sets of carefully-balanced triple-expansion engines, with all the latest improvements in auxiliaries, and three large double-ended steel multitubular boilers working under forced draught.

Arankola.—On November 2nd, at high water, Messrs. Workman, Clark & Co., Ltd., of Belfast, launched from their South Yard a new twin-screw steamer to the order of Messrs. The British India Steam Navigation Co., Ltd. The new vessel has been named *Arankola*, and is 404 feet in length, with a gross tonnage of about 4,550. Accommodation for about fifty first-class passengers is provided in commodious state-rooms arranged for one, two and three persons, and for about fifty second-class passengers in large three-berth rooms, all on the shade deck. The first-class public rooms include a spacious and well-lighted dining-saloon, a tastefully-furnished social hall, and a comfortable smoke-room on the promenade deck, while the second-class passengers have a comfortably-furnished dining-saloon on the shade deck, and special attention has been given to the ventilation of all parts of the passenger accommodation. The cargo space is divided into three holds, each of which is provided with a large hatchway equipped with winches, derricks and the necessary gear for expeditiously handling a full general cargo. The *Arankola* will be propelled by two independent sets of quadruple-expansion engines, carefully balanced to minimise vibration, and having all the most modern improvements and auxiliaries, steam being supplied by six large steel boilers of cylindrical, horizontal, multitubular type, working under an approved system of forced draught. The construction of the vessel has been carried on under the special supervision of Lloyd's Surveyors to qualify for the highest class in their Registry, while the requirements of the British Board of Trade for a first-class passenger steamer are also fully complied with.

TRIAL TRIPS.

Rotorua.—Speed trials were recently run on the Firth of Clyde by the new "combination" steamer *Rotorua*, which has been built by Messrs. William Denny & Bros., Dumbarton, for the Union Steamship Company, of New Zealand. The trials were thoroughly successful, a mean speed of 15·77 knots being attained. The *Rotorua* is 484 ft. in length, and is the second ship belonging to the Company's fleet to be fitted with a combination of turbines and reciprocating engines. The first vessel, which was also the first ship of the type, was the *Otaki*. The *Rotorua* has accommodation for 52 first-class, 72 second-class, and 410 third-class passengers. She will be able to carry 105,000 carcases of sheep in specially insulated holds.

Strathan.—The new steel screw steamer Strathan, the third of four vessels ordered by Messrs. Burrell & Son, Glasgow, from Messrs. Archibald M'Millan & Son, Dumbarton, has run trials on the Clyde, attaining a speed of 12½ knots. The machinery, which was supplied by Messrs. David Rowan and Co., Glasgow, worked in a very satisfactory manner. For Launch see October issue.

Explorer.—The new steamer *Explorer*, built for Messrs. T. & J. Harrison, Liverpool, by Messrs. Chas. Connell & Co., Scotstoun, and engined by Messrs. Dunsmuir & Jackson, Govan, recently carried out official trials. A mean speed of 14 knots was obtained on the measured mile, the engines running seventy-seven revolutions per minute and developing 4070 indicated horse-power. On completing her trials the vessel proceeded on a voyage to Galveston. Messrs. Matthew Keenan & Co., Ltd., had the contract to cover all the boiler and steam pipes on board. For Launch see October issue.

Bore.—On October 21st, the s.s. *Bore*, of about 2,200 tons deadweight, built by Messrs. The Campbeltown Shipbuilding Company for The Stockholms Rederiaktiebolag Svea, Stockholm, ran her official trials on the Clyde with entirely satisfactory results, and an average speed of over 11 knots was attained. The *Bore* is a vessel of the well-deck type, having

raised quarter-deck, bridge and topgallant forecastle. Her machinery has been supplied by Messrs. J. G. Kincard & Co., Ltd., Greenock, and consists of triple-expansion engines, with two large main boilers, working at 180 lbs. pressure. She is fitted with electric light, Welins' patent davits, Mannesmann patent steel derricks, and is otherwise specially arranged throughout for the general trade of the Company.

Gloucestershire.—On October 22nd, the s.s. *Gloucestershire*, built by Messrs. Harland & Wolff, Ltd., to the order of Messrs. Bibby Bros. & Co., Liverpool, for their eastern trade, left Belfast harbour. Mr. Arthur W. Bibby crossed in the vessel, also Lord and Lady Pirrie, Mr. Ramsay (superintending engineer), and Mr. Richard Hall (chief engineer), under whose inspection the vessel and machinery have been built. Capt. G. H. Harris was in command of the vessel. For Launch see August issue.

Star of India.—On October 26th, the new steel twin-screw steamer *Star of India*, the latest addition to the Star Line fleet of steamers owned by Messrs. J. P. Corry and Co., of London, left Belfast Harbour and proceeded down the Lough for adjustment of compasses, after which she underwent her speed trials over the measured mile course. The results attained were highly satisfactory, and the vessel subsequently left for Barry to take in coal, preparatory to leaving on her initial voyage to Australia. For description of Launch see November issue.

Intaba.—On October 29th, this steamer, the largest ever built in Aberdeen, and the first which has been constructed under Board of Trade inspection for passenger service, has been completed by Messrs. Hall, Russell & Co., Ltd., to the order of Messrs. John T. Rennie, Son & Co., of London and Aberdeen, and was taken for trial at sea. Mr. G. H. Rennie, the senior of the owners' firm, was on board with a party of friends and was accompanied by Mr. Johnson, representing his firm of consulting engineers. A most satisfactory trial trip was made, after which the vessel proceeded south to take up her duty. For a description of the Launch see October issue.

Æneas.—On November 1st, the *Æneas*, the first of three vessels under construction by Messrs. Workman, Clark and Co., for Messrs. Alfred Holt & Co.'s Blue Funnel Line, left the builders' yard and went down the Lough for adjustment of compasses. After the trial, which was thoroughly satisfactory in every way, the vessel proceeded to Glasgow to load. For description of the Vessel and Launch see October issue.

Hova.—On November 2nd, the steel screw steamer *Hova*, built by Messrs. The Northumberland Shipbuilding Company, Ltd., Howdon-on-Tyne, to the order of F. S. Holland, Esqr., left the Tyne for her official trial trip. This vessel is of the 'tween deck type, and is over 390 ft. long by 49 ft. beam, and has been built under Lloyd's special survey to obtain the highest class, and is designed to carry 7,500 tons on a light draught. She is arranged with poop, long bridge and topgallant forecastle, and has water-ballast provided in the cellular double bottom and after peak. She is fully equipped with all necessary appliances in the way of deck fittings and machinery to facilitate the loading and discharging of cargo, the accommodation, which is very ample, being placed in steel houses on the bridge deck. The propelling machinery, which has been constructed by Messrs. The North-Eastern Marine Engineering Co., Ltd., Wallsend and Sunderland, at their Northumberland Engine Works, Wallsend, consists of a set of the latest type of triple-expansion engines, having cylinders 25 in., 41 in., 69 in. by 48 in. stroke, the steam being supplied by three large steel boilers working at a pressure of 180 lbs. per square inch. The trial trip proved in every way satisfactory. After the trial the vessel was taken to Tyne Dock to load for Italy, under the command of Captain Ross.

Harpalion.—On November 10th, the handsome steel screw steamer *Harpalion*, built by Messrs. Wm. Gray & Co., Ltd., to the order of Messrs. J. & C. Harrison, Ltd., London, was taken to sea for her trial trip. The hull and machinery have been constructed under the superintendence of Mr. Wm. Crandell, the superintendent to the firm, and that gentleman, together with Mr. Graham, witnessed the trial on behalf of the owners. An average speed of 13 knots was maintained, and the performance of ship and machinery was entirely satisfactory. After the trial the vessel proceeded on her voyage to Cardiff to load. For description of Vessel and Launch see November issue.

Steel Tug.—This tug is 51 ft. by 11 ft. by 7 ft. 4 in. from keel to pilot deck, and has a draught of about 4 ft. 6 in., and has been built by Mr. Edward Hayes, Stony Stratford, for service in North Africa, and is a duplicate of many others sent out there by Mr. Hayes. Four bulkheads are fitted and the steel floors are extra deep to give strength in case of grounding, and to minimise vibration. The main engine is a "Hayes" standard C.S.C., of open front type, having cylinders 8 and 16 inches by 10 inch stroke. Automatic lubrication and water service are both fitted. The air, circulating, feed and bilge pumps are worked off the l.p. crosshead, with long rocking levers. The boiler is of the marine return-tube type, built under Lloyd's Survey for 120 lbs. w.p. The bilge ejector and auxiliary feed-boiler pump are of the most efficient type. The pilot house is of teak of specially strong structure. The trial trip was carried out in very rough weather, nothwitstanding which the average speed made was 12 miles. The trial was conducted by Mr. Arthur Hayes.

BOARD OF TRADE EXAMINATIONS.

1910 Extra First Class.

Nov.	3rd—Aitken, J.	Ex 1C Leith
,,	3rd—Austin, J.	Ex 1C Glasgow
,,	3rd—Berry, C.	Ex 1C N Shields
,,	3rd—Bond, G. E	Ex 1C Liverpool
,,	3rd—Currie, A	Ex 1C Glasgow
,,	3rd—Evans, W.	Ex 1C Liverpool
,,	3rd—Grieve, C. J K. ..	Ex 1C Hull
,,	3rd—Macdonald, N. C. ..	Ex 1C N.Shields
,,	3rd—Proudfoot, H.	Ex 1C Glasgow
,,	3rd—Staines, S. E.	Ex 1C London

NOTE—1C denotes First Class: 2C Second Class.

September 29th, 1910.

Atkinson, T. K.	1C Liverpool
Bagshaw, J. C.	1C Liverpool
Baird, R. W. ..	1C Greenock
Billett, R. W...	2C London
Black, R.....	2C Greenock
Brown, W. J...	2C N.Shields
Caldwell, P. ..	2C Liverpool
Campbell, H. ..	2C N.Shields
Davies, E. T. ..	1C Liverpool
Davies, J. L. ..	2C Hull
Dongan, W. C.	2C Liverpool
Drewry, H. W.	2C London
Fothergill, F.M.	2C Aberdeen
Freeman, J. G.	2C Hull
Galloway, J. K.	2C Liverpool
Hargrave, W. T.	1C London
Harvey, W. H.	2C Hull
Hodgson, P. B.	1C Hull
Hume, J. D. ..	1C N.Shields
Jacks, H. N. ..	2C Liverpool
Jeffrey, W.	1C Sunderl'd
Jones, T. E. ..	2C Bristol
Law, H. S.	1C Sunderl'd
Mackay, T. S...	1C Greenock
M'Crea, J. A...	2C Greenock
Porteons, J.....	2C Greenock
Price, M. L. ..	2C Liverpool
Robertson, D...	2C Greenock
Rowlands, H. T.	1C Hull
Slade, H. H. ..	2C Bristol
Smith, C. S. ..	2C Sunderl'd
Snowden, A. ..	1C Sunderl'd
Stewart, A. M.	2C Greenock
Truscott, J. J...	2C Bristol
Tunstall, F. ..	1C Sunderl'd
Welch, H.	2C London

October 6th.

Abraham, W.B.	1C South'ton
Aggett, W. C. A.	1C Cardiff
Askew, E. B. ..	1C Liverpool
Auchterlonie, R.	1C Leith
Baird, G. B. ..	2C Glasgow
Borland, John..	2C Glasgow
Brice, E.	2C Cardiff
Clark, C. H. ..	1C N.Shields
Cooke, Fred ..	1C Cardiff
Cox, H. H.	1C London
Cramond, J. S.	1C Leith
Donkin, D. D.	1C N Shields
Fraser, W. H	2C London
Griffiths, S.W.H.	2C Liverpool
Hay, J. S.	2C Belfast
Hornby, W. R.	1C Liverpool
James, C. D. ..	2C Cardiff
Kneale, W.	1C Liverpool
Lloyd, T. N. ..	2C Cardiff
Macnee, C. M.	2C Leith
Mail, M. E.....	2C N.Shields
M'Millan, D. C.	1C Glasgow
M'Murrick, R.	1C Glasgow
M'Neilly, W. ..	2C Belfast
Moller, C. R. B.	1C N.Shields
Murray, W	2C Glasgow
Petrie, D. C. ..	1C Leith
Pickering, E. ..	1C N.Shields
Powell, A.	2C Cardiff
Reid, W.....	1C Glasgow
Revington, W.D.	2C London
Rowney, F. H.	1C Cardiff
Shaw, R. H. ..	1C Liverpool
Simeonidis, S.	2C N.Shields
Smith, D.....	2C Glasgow
Stevenson, R...	1C Liverpool
Sumner, B. S...	2C Liverpool
Taylor, D.	1C Leith
Teasdale, M. ..	2C Glasgow
Thomas, W.E.A.	1C Cardiff
Thomas, W. H.	2C Cardiff
Urquhart, D.W.	2C Leith
Wilson, A. M...	1C London
Woodward, T.G.	2C Liverpool

October 13th

Blamey, F. J...	1C Liverpool
Bridson, R. H.	2C Liverpool
Brown, W. N.	2C N.Shields

Board of Trade Examinations—*continued.*

Cawood, E.	1C	Hull
Ferguson, W.M.	1C	Greenock
Fleming, C. P.	1C	Dundee
Goddard, J. A.	2C	London
Hughes, C. L.	1C	London
Hutchins, C.L.H.	2C	Liverpool
Lamberd, G.	1C	N.Shields
Latus, H. J.	2C	Hull
Macintosh, A.	2C	London
Martin, F. R.	1C	Liverpool
Meldrum, R.	2C	Dundee
M'Kenzie, A. C.	1C	Greenock
Mullen, A.	1C	Greenock
Parry, J.	2C	N.Shields
Peacock, J.	2C	N.Shields
Ramsay, W.	1C	Greenock
Ray, D. R.	1C	London
Taylor, J.	2C	N.Shields
Thirkell, R. F.	2C	Liverpool
Webb, T. H.	1C	London
Webster, J. S.	1C	Hull

October 20th

Baxter, R. P.	2C	Leith
Bradshaw, L. P.	1C	Liverpool
Croll, A. M'A.	2C	Glasgow
Cross, J.	1C	Liverpool
Cumming, J. H.	1C	Leith
Drew, R. J.	2C	Plymouth
Drummond, J.N.	2C	W.Hart'l
Fraser, A.	1C	Glasgow
Hall, G. W.	2C	Liverpool
Heney, W. J.	1C	Cardiff
Hindle, J. T.	2C	Liverpool
Hugh, L. R.	2C	Cardiff
Hughes, W. A.	1C	Barrow
Hunter, C. N.	2C	Glasgow
Iliff, G.	1C	Cardiff
Jackson, E. G.	1C	N.Shields
Jones, H O.	1C	South'ton
Jones, R. E.	1C	Liverpool
Lafrenais, C.	2C	Cardiff
Leigh, B. J.	2C	W.Hart'l
Liley, W. G.	1C	Cardiff
Lyne, W. S. L.	1C	Liverpool
Macleod, J. M.	2C	Glasgow
Martin, F. E.	2C	South'ton
May, W. S.	1C	London
M'Nally, S. J.	2C	Liverpool
Parker, B. J.	1C	South'ton
Redfern, D.	2C	Leith
Rees, A. C.	1C	Cardiff
Simpson, A. E.	1C	Glasgow
Small, W.	1C	Leith
Stopforth,	2C	Liverpool
Story, T. R.	2C	W.Hart'l
Swanwick, L. T.	2C	W.Hart'l
Taylor, G. D.	1C	N.Shields
Thomson, T.	1C	Barrow
Tindale, E. A.	2C	W.Hart'l
Turner, W. S.	1C	London
Vickers, R. J	2C	W.Hart'l
Vlassopeulos, S.	1C	London
Watson, W. R.	1C	Barrow
Wheatley, S. J.	2C	W.Hart'l
Whittaker, W.J.	2C	W.Hart'l
Williams, G. H	2C	Liverpool

October 27th.

Anderson, D. M.	1C	London
Ashton, R. N.	1C	Liverpool
Bowden, N.	2C	Liverpool
Cable, F. C.	1C	London
Cann, W H. E.	1C	Bristol
Cowens, W.	2C	Sunderl'd
Dawson, R.	1C	Sunderl'd
Day, T. R.	2C	N Shields
Evans, W. W.	2C	Liverpool
Ferries, J. D.	1C	Aberdeen
Griffith, J.	1C	Liverpool
Grose, F. J.	2C	Bristol
Harrison, J. T.	1C	Hull
Hauff, R.	1C	Sunderl'd
King, J. W.	1C	N.Shields
Laycock, W.	2C	Hull
Lennon, E. M.	1C	N.Shields
Marshall, J. S.	2C	Hull
Miller, J. T.	1C	N.Shields
Miller, T. F.	1C	Greenock
Mitchell, T.	1C	Greenock
Morris, J. J	1C	Liverpool
Murphy, T.	1C	Liverpool
Oliver, W. T.	1C	Greenock
Patterson, C.	2C	N.Shields
Pitt, E	1C	Hull
Pollock, D. F.	1C	Greenock
Price, E. F.	2C	N.Shields
Ridler, Percy	1C	Bristol
Skagen, B.	1C	N.Shields
Slack, C. J.	2C	Liverpool
Steel, T.	2C	Greenock
Swinson, G. A.	2C	Sunderl'd
Teasdale, J	1C	N Shields
Thomas, M. J.	1C	Liverpool
Thomas, O D.	2C	Liverpool
Thomson, J. L.	1C	Greenock
Tweedlie, A. S.	1C	Greenock
Vickers, A. E.	1C	Hull
Walker, W.	1C	Greenock
Wilkinson, I.	2C	N.Shields
Williamson, D	2C	N.Shields
Winton, E.	1C	Sunderl'd

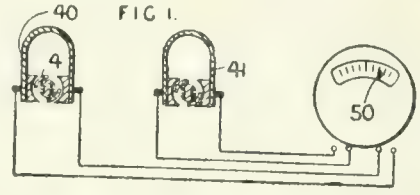
November 3rd.

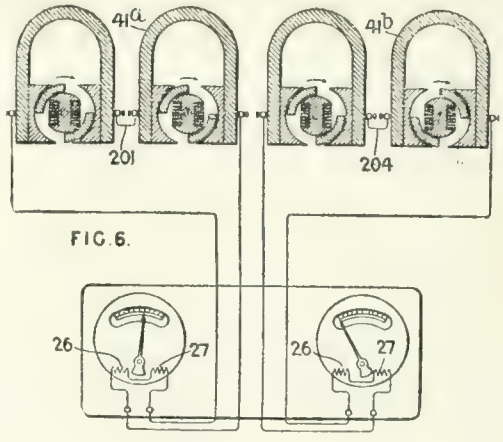
Barnett, T. W.	1C	Cardiff
Barrass, S.	1C	N.Shields
Best, H. C.	1C	Liverpool
Birnie, J.	1C	London
Bradbeer, E.	1C	N.Shields
Cairns, J.	2C	Leith
Charlton, W. D.	2C	N.Shields
Craig, David	2C	Leith
Dadds, I. L.	2C	Cardiff
Dupres, J. W.	2C	London
Elsdon, J. W.	1C	N.Shields
Ferguson, J. W.	2C	Glasgow
Forbes, W. K.	1C	Leith
Gemmell, G.	2C	Glasgow
Hallet, G. N.	1C	Cardiff
Harrison, E. C.	2C	Cardiff
Harrison, T.	2C	N.Shields
Hauxwell, L.	1C	Belfast
Hill, F. H.	1C	N.Shields
Hopgood, B. E.	1C	Cardiff
Hughes, G. L.	2C	Cardiff
Kennard, J. E.	2C	Cardiff
Kerr, J. D.	1C	Glasgow
Leonard, F.	2C	Liverpool
Lloyd, J. A.	2C	Cardiff
Lockhart, J.	2C	Belfast
MacOnie, J. G.	2C	Glasgow
Malcolm, W.	1C	Glasgow
M'Donald, J.	1C	Leith
M'Kenzie, J. A.	1C	Leith
Millar, A. R.	2C	London
Millar, F. E.	1C	London
Miller, E. L.	2C	South'ton
Milne, T. A.	1C	Glasgow
Mitchell, D.	2C	Glasgow
Mitchell, F.	1C	Leith
Morgan, D. E.	2C	Cardiff
Newell, H. L.	2C	Glasgow
Parsons, C. J.	2C	South'ton
Popham, H. E.	1C	Cardiff
Richardson, W.	1C	Leith
Rowe, W. A.	1C	Falmouth
Rudkin, J. S	1C	Liverpool
Sketch, H. S.	2C	South'ton
Tocher, J.	2C	Leith
Topping, E. E.	1C	South'ton
Yates, F. B.	2C	Liverpool

The Marine Engineer and Naval Architect Patent Record.

Compiled by Messrs E P Alexander & Son, Chartered Patent Agents, 306, High Holborn, London, W C

16,827. Speed Indicators, etc. In electric apparatus for indicating the speed and direction of rotation of a shaft, etc., the indicating-means is connected by independent circuits with two or more generators driven by the shaft, the arrangement being such that the currents generated are in phase or out of phase according to the direction of rotation, and the indicating-means consequently shows both the speed and the direction of rotation. The magneto-electric generators 40, 41, Fig. 1, with stationary armatures and rotating inductors 4 are respectively connected with a movable coil and a fixed set of coils in a speed-indicating voltmeter 50. One inductor is fixed to the shaft, but the other can slip through 90 degrees with respect to it, the result being that during rotation in one direction the currents are in phase and the indicator shows speeds say to the right of the vertical, while when reversal takes place the second inductor slips and





the currents are out of phase, the speed indications being then given to the left. In a modification adapted for giving indications at various points, for example on a battleship, the armatures are provided with two or more separate windings connected with the different instruments. These windings may take the form of a number of insulated wires grouped around a central core of wire to form a single cable with which the armature is wound in the usual manner. In the arrangement shown in Fig. 6, two volt-meters are employed, one giving forward speeds and the other astern speeds. Each instrument is in circuit with a pair of generators, the members of which are connected in series as at 201, 204. The inductors in the case of one member of each pair, namely 41^a and 41^b, are adapted to slip, but in opposite senses. When forward rotation occurs, the corresponding instrument is actuated, but the other is unaffected owing to the generators connected with it, producing currents of opposite phase and therefore neutralizing each other. When reverse rotation occurs, the first pair give no current, but the other two generators are in phase and produce speed indications on the astern indicator. The volt-meter employed in this arrangement consists of two field coils 26, 27, and a metal extension of the pointer arranged between them.

The Marine Engineer

And Naval Architect.

LONDON, JANUARY, 1911.

THE hours of 1910 are numbered in time past and the events comprised within its borders are being gathered into the folds of tradition to make or mar the ideals, the views and the actions of future generations according to the use made of the good for example and expansion, and of the evil for warning and avoidance. That this applies not only generally, in respect to the moral sense of the whole nation, but also specifically, to the commercial and technical communities, may be evidenced from the unhappy differences which have resulted in so much deplorable suffering owing to strikes, lockouts and other labour troubles, especially towards the close of the year. It has been stated that the outsider who poses as a champion ostensibly to bring about a settlement, frequently not only retards and hinders such, but, by his want of tact, added to a certain amount of bluster, helps to pave the way for further bitterness, and drives wider apart the essential elements which, fittingly combined, give prosperity to the country. A word spoken in season is good, but many words spoken have not been so in connection with recent labour troubles, and lessons may be fittingly learned from such which may be of service in days to come. We have admired employers who knew not only every man and boy in their employment, but took an interest in them, and we have seen the introduction of outside influence change the happy spirit existing, into turmoil and strife. The selfishness that seeks to prevent a man putting his best work into his handicraft, to keep him on the borders of mediocrity, is most pernicious; and we cannot shut our eyes to the fact that it has operated detrimentally, and is deplored by the more honest and industrious of the craft who would scorn to accept the wages of idleness or give less than the duty of their best work and labour. We have known employers too, who, overcome by the greed of gain or careless of their responsibility, sought to pay those who served them quietly and faithfully, the least possible amount, regardless of either their ability or faithfulness to duty; and here we have the same selfish spirit displayed as in the former case.

Doubtless such cases combined have tended to bring about divisions through the instrumentality of those who seek to engender strife and keep it alive, of set purpose. Dr. Inglis, in his presidential address to the Institution of Engineers and Shipbuilders in Scotland in 1893, referred to the exodus of the Israelites from Egypt as one of the great strikes of the past, and it is agreed that Moses was justified in his leadership over the brickmakers. The spirit of Pharoah is still alive, that of Moses is not so manifest, still less is that of a greater than he, else would a way out of the difficulties have been found ere innocent dependencies were brought into a state of untold misery. Is patriotism dead that there should be such strife between sections of our people? We see this in municipal and political life and we must protest against that diabolical spirit which seeks to regard animosity as a fit weapon to serve for a selfish end. In the interests of national prosperity, the sooner a happier understanding of the rights and privileges, the duties and freedom of every man is arrived at the better. The policy of give and take has become a byword and the degenerate form is, "you give and I take." The cultivation of rare sense until it becomes common is most desirable among those who pose as leaders, so that the united interests of trade and commerce may suffer less from sheer folly and tactless utterances than they have in the past years. The troubles in the shipyards, in the mines—coal and metal—and in the mills, during the year have not only entailed loss of comfort and provision to large sections of the people, but brought suffering and poverty to many more, disturbed the tone of communities, and held back general progress. The losses sustained by the workers, whether under the heading of Capital or Labour, in the course of the past six months have been very great and, to some extent continental ports and their workers have been the gainers, but the major part of the losses, not being recoverable, is gone like the two golden hours between sunrise and sunset of yesterday. The lockout in the shipyards is now happily ended, and it is to be hoped that the lessons which have arisen out of it will serve for the good of all concerned.

The reversing Steam Turbine has not yet received the stamp of success, but several drawings and models submitted recently have shown possibilities, some of the ideas being ingenious, while at least one bears the impress of feasibility and may prove its efficiency in the coming year. The Gas Turbine has also been continuing to exercise the inventive faculty; the announcement indeed has been made that the gas turbine has been evolved and is in course of development. The combination of Reciprocating and Turbine Engines has not been adopted to any great extent during the past year. The Electric drive and the Magnetic drive as media for transmitting and transforming power, in order that the best revolutions for developing power may be used in the prime mover and transformed to give the best revolutions for the propeller, have not advanced much since this time last year, but each has its exponents, and each is being brought nearer to actual service.

The Internal Combustion Engine for marine work has made considerable progress; its extending use in coastal waters, fishing craft and the like, goes to show that it is fit for the purpose, as certainly it is economical. The vessels now in course of construction to be driven by this class of engine for cargo service,

show a distinct advance and the results will be noted with great interest. The year has been notable for the launch of the largest vessel ever built, for the announcement of a further advance upon it in size and speed, and for the more recent news that a new Cunarder has been resolved upon, larger than its predecessors, but less in speed.

The Centenary of a well-known Clyde firm of shipbuilders and engineers recalls the enormous change and advancement made since the *Comet* and *Charlotte Dundas* of a hundred years ago. It may be noted that Messrs. Simons removed from the Clyde to Canada with the intention of building vessels near Montreal, but the venture was not a success and they returned to the Clyde. Now Canada is advancing apace and Port Arthur is on the eve of opening a dry dock and of starting shipbuilding, while iron smelting works and foundries are competing to supply what is required to keep the workshops going with products of Canadian soil.

The carriage of produce from the Colonies and South America has been increased during the year and more steamers have been added to cope with the demand for refrigerated food material. The increased and increasing sizes of steamers have led to the principal port authorities moving in the matter of larger dry docks, also river and harbour depths in order to give the accommodation demanded. The freight markets have been improving and the employment of more tonnage to meet the requirements has led to enquiries for new steamers, which have resulted in orders being placed to such an extent that Prosperity awaits on the twin elements, Capital and Labour, to unite in pushing forward the work to that stage desired for, and by, the good of the country. Trade and Commerce, which depend upon demands for various goods, appear to ebb and flow like the waves of the sea, but without the regulating influences which bear upon such to control and to guide these at stated intervals. The flowing tide of trade brings forth many argosies and in such abundance that the surfeit comes all too soon, while the ebb is more rapid than is due to the normal natural causes, arising from a demand for goods which has either been created by fashion, by a shifting of the money market, or by a dearth of materials in different portions of the world to meet the requirements of shifting populations arising from emigration or immigration. Some very fine steamers have been launched and started on their careers during 1910, and the increased tonnage built and booked has been in advance of recent years, all of which are points for congratulation. The losses of vessels have not been light unhappily, and the disappearances of a few steamers, leaving little or no trace, have added to the mysteries of the sea. One consideration appealed strongly to us in the closing weeks of the year, that derelicts and submerged wrecks are dangers to navigation and ought to be reported carefully, and arrangements made to sink them at once.

We wish our readers all prosperity during the new year upon which we are entering.

MOTOR BATTLESHIPS.

THIS is an age of surprises, and we presume that the announcement made a few days ago by a contemporary as to the inclusion of a "Dreadnought" with 36,000 h.p. oil engines in a naval programme of the near future was meant to be one of the surprises. We cannot think, however, that the statement has been made with a full sense of responsibility, although it may be known that the British Admiralty, among other bodies, has been paying a good deal of attention to the propulsion of war vessels by oil engines. We cannot believe that the Admiralty would for one moment decide to instal oil engines of 36,000 h.p. into a first-class battleship without having previously obtained experience on a progressive basis from vessels of a much smaller size and power. It must be remembered that 1,000 h.p. is about the limit that has yet been reached in actual sea experience in oil engines and the results have been most successful. As we have recently pointed out, the problem of the marine oil engine is receiving a great deal of attention in many countries, and it is reasonable to assume that considerable developments may show themselves in the near future. We may remind our readers of the 8,000 ton Hamburg-American liner, which is being built by Messrs. Blohm & Voss, of Hamburg. This vessel is to have two oil engines of 1,500 h.p. each, but we would point out that even if this vessel is successful when thoroughly tested under every-day conditions, it is a far cry from 3,000 h.p. to 36,000 h.p. It will be recognized that the wise course would be the gradual development of the use of high-powered oil engines by such stages, as the success of each stage could be practically assured from those that have preceded it. We believe that on the Continent an oil engine of moderate power has been made and thoroughly tested which is readily reversible, and can be simply and quietly varied in speed with absolute certainty of action from maximum speed to about 15% of such maximum, a ratio of 6½ to 1, a result which would seem to fully comply with the necessary conditions to be laid down for such a motor as a marine engine. The crux of the problem at present would seem to be the size of a single unit, and whether it should be single or double acting. Then again comes the important question of a two-stroke or a four-stroke cycle to be decided on, having regard to fuel economy on the one hand and ease of manipulation on the other. Although Continental engineers have made considerable strides in the development of th oil engines, it is interesting to note that English engineers are waking up to the importance of this

branch of industry judging by statements recently made. For example, Lord Furness, as the chairman of Messrs. Richardsons, Westgarth & Co., stated that this firm were proposing to build engines of the Diesel type, and in addition to this we understand that Messrs. Swan, Hunter and Wigham Richardson are already carrying out trials on the Tyne on a vessel fitted with oil engines. It will be interesting to see how much weight and space can be saved with oil engines as compared with steam in the case of a large installation. There is a considerable saving in the weight and space occupied by the oil fuel in comparison with coal. First, oil occupies less space than coal, weight for weight, and secondly the oil engine is capable of giving at least five times the power per unit of weight of oil than a steam engine of high efficiency per coal unit. In a war vessel these points may have an important bearing on the capacity of ships as an offensive factor, particularly in view of the fact that oil can be stocked in parts of the vessel which are otherwise unusable, for instance, the double bottom, thus leaving the usual bunker space for other purposes or for fuel storage, by which the radius of action might be increased to six or seven times if the displacement for fuel was available after providing for the armament necessary. Taking all things into consideration we think we are justified in saying that in spite of all the advantages of the oil engine, the British Admiralty or any foreign power is not likely to make a big leap in the dark by fitting a first-class war vessel with internal combustion engines of a power thirty or forty times as great as any that have been used under ordinary working conditions. There is, of course, more need for caution in dealing with naval matters than with commercial ones, and the average shipowner's deliberate and cautious treatment of any new development may well be copied by our naval authorities.

REFRIGERATION

AMONG the subjects which marine engineers have, by the force of advancing circumstances, found it necessary to study and to devote their attention to, there is no more exacting and important one than refrigeration, and the carriage of refrigerated cargoes. The importance of the subject may be gauged by the ever-increasing number of steamers engaged in the trade and the enormous amount of produce carried. Since about seventy years ago, when the use of sulphuric ether was brought into service for refrigerating purposes, the progress of the science has been steady, but slow. The last thirty years have seen an acceleration, assisted probably by troubles and threatened scarcity of meat, arising out of the epidemics among cattle, the law of nature intervening to induce thought and the inventive faculty to bring forth actively at the auspicious time the means of providing what was lacking to maintain an equilibrium in the market place. The early efforts at refrigeration were by chemical media, these were succeeded by the mechanical process of cold air discharge, attained by compression, cooling and expanding, which found favour for a time, but gave place to the more economical system of to-day. The more or less experimental work of Shaw, Harrison, Carré, Reece, Bell, Coleman, Siebé, Kirk, Tellier and others has gradually brought the refrigerator from its crude state into the present highly finished, reliable and economical machine on the carbonic acid and ammonia systems. There are many interesting and profitable discussions raised from time to time on questions in connection with refrigeration, among these are the advantages and disadvantages of the different systems; of insulating materials; of frozen and chilled meat; of critical temperatures for fruits and dairy produce; of bacteria and parasites found in commodities, including also an investigation on the worm found in quarters of beef under certain conditions, and whether the worm in question is detrimental to the meat, or only to its immediate locality. A series of articles dealing with refrigeration will be published in this and subsequent issues, which it is hoped will be of interest and advantage to our readers.

THE DOCK SYSTEM OF MESSRS. CAMMELL, LAIRD & CO.

THE extensive system of dry and wet docks now owned by Messrs. Cammell, Laird & Co., Ltd., form no inconsiderable portion of the world-famous aggregate of docks situated on the Mersey. This article will deal with those docks on the Birkenhead side of the river which come under the above heading, and are distinct from the great system controlled by the Mersey Dock and Harbour Board in Liverpool, and also in Birkenhead. Very briefly the history of this long-established firm is as follows. The Birkenhead Iron Works were commenced in 1824, the founder being Mr. William Laird, and it may be of interest to note that Mr. William Laird in 1822 was one of the promoters of the St. George's Steam Packet Co., formed to run vessels between Liverpool and Glasgow, and later from Dublin and Cork to English ports. This Company owned the *Sirius*, which was the first steamship to cross to New York. Mr. John Laird was elected the Member for the Borough of Birkenhead, which was created a Parliamentary Borough in 1861, and which he represented until 1874. In 1857 Mr. Laird retired from the business, and the works were then carried on by his three sons. The name of the firm had previously been that of John Laird. It now became Messrs. John Laird, Sons & Co. Mr. John Laird retired and the works were carried on as "Laird Bros."

In 1900 the Tranmere Bay development was commenced, when the Development Company was run conjointly with that of Messrs. Laird Bros., Ltd. In 1903 the amalgamation of Messrs. Cammell, of Sheffield, with Messrs. Laird Bros. took place, from which time the name has been that of Messrs. Cammell, Laird & Co., Ltd.

In 1829 the first iron vessel was built, *viz.*, a barge for river navigation. At this time Mr. John Laird, son of Mr. William, took an active part in the firm. Between 1833-4 two iron steam vessels were built for the City of Dublin Steam Navigation Co. In 1834-5 two iron steamers were built for the Hon. East India Co., for the exploration of the River Euphrates, to be under the command of Capt., afterwards General, Chesney. Following after the building of these vessels, the

iron vessel became to be generally adopted. In 1834 Mr. Laird built the *John Randolph*, for G. B. Lamar, of Savannah. This paddle steamer was shipped in pieces at Liverpool and put together on the Savannah River, being the first iron vessel seen on American waters. It may be claimed that Mr. Laird built the first iron vessels for use in India, China, South America, United States and Egypt.

During the Russian War, Mr. John Laird performed some remarkable feats, a type known as a mortar vessel being built in the short space of three weeks. This vessel was named the *Cupid*, and carried a load of 102 tons. Fifteen of these vessels and fourteen gunboats of 230 tons burthen, twenty-nine vessels in all, were completed in eight months from time of order, *viz.*, nearly one per week.

Previous to the building of the present docks and works under the name of The Birkenhead Iron Works, the business had been carried on at the Wallasey Pool. The Docks of the present works include five graving docks.

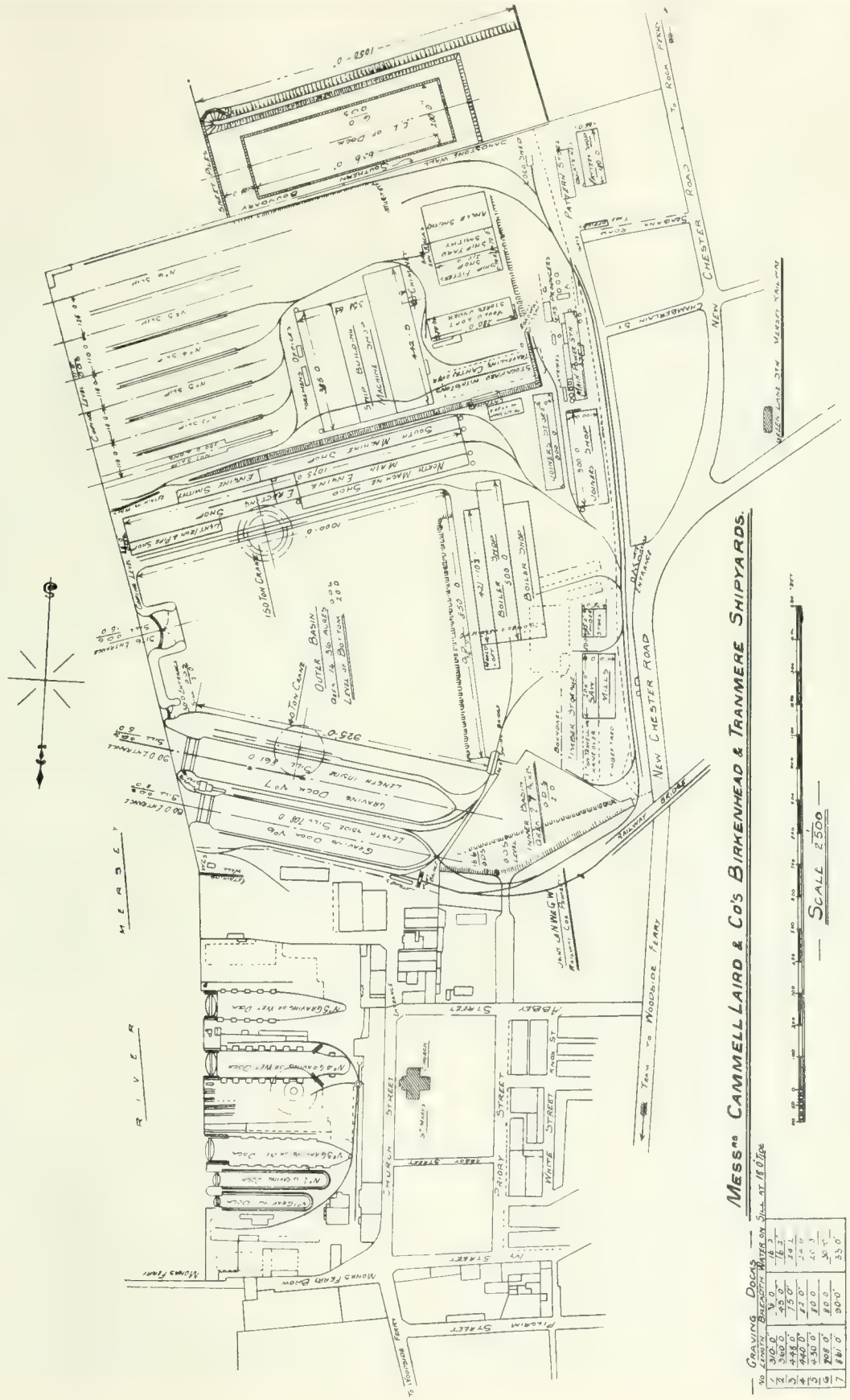
			Depths on 20 ft. tide.
No. 1.	300 ft. long,	40 ft. wide	18 ft. 3 in.
No. 2.	360 ,, ,,	45 ,,	18 ft. 3 in.
No. 3.	425 ,, ,,	75 ,, ,,	26 ft. 0 in.
No. 4.	440 ,, ,,	85 ,, ,,	22 ft. 3 in.
No. 5.	375 ,, ,,	85 ,, ,,	22 ft. 3 in.

On the north side of No. 4 Dock a 50-ton steam crane for lifting machinery into vessels is placed. The engineers', smiths' and joiners' shops extend about 1000 ft. The engine, erecting and fitting shops are three in number, the brass finishing shop being on the first floor. The total area of the old Birkenhead Iron Works is over 20 acres.

The Boiler Shop was originally started in Liverpool in the shipyard of Mr. Wm. Laird, at the time the works were being also carried on at the Wallasey Pool. It was a small structure with wooden lean-to roof, and it was here that No. 1 boiler was started about the year 1855. No. 2 set of boilers were for Woodside Ferry Steamer *Liverpool*. This shop was not large enough to cope with the work, and was removed to Birkenhead. In the year 1888 the boiler shop at Beaufort Road was opened, and since that time up to the commencement of the boiler shop at Tranmere all work of the boiler department was carried out at Beaufort Road, adjacent to the great float, and thus distinct from the old Birkenhead Iron Works. The shop comprises an area of 17,350 square yards, and is replete with all latest tools and appliances for carrying out the various stages of boiler making—flanging presses worked by hydraulic power, and various kinds of motor-driven and compressed air machines being utilized in the operations. All classes of boilers have been turned out, from the old square boilers, working at a pressure of 15 lbs. per square inch, to the latest Scotch boilers, with their pressures of 210 lbs. and their large diameters of 17 ft. 3 in., which necessitates the use of shell plates $1\frac{3}{4}$ in. thick and rivets of a corresponding dia. of $1\frac{3}{4}$ in.—water tube boilers of all types and locomotive boilers of every description being dealt with in a very large degree. The number of boilers turned out, of all descriptions, taking an average for three or four years, are about seventy boilers per year, or about one-and-a-third boilers per week. The new boiler shop at Tranmere has all the latest tools, cranes and appliances for dealing with every phase of modern boiler work and is described hereafter.

The Docks, Shipyard and Engine Works contained in the New or Tranmere portion of the works may perhaps be best described by briefly reviewing the construction of this large undertaking. At its commencement, 62 acres were developed, but eventually this became 75 acres, and with the old works a total of 108 acres is now the extent of the docks and works. The works comprise two graving docks 708 and 861 feet effect in length. An outer floating basin of 15 acres in area and an inner ditto, shallower, of $2\frac{3}{4}$ acres. The land at the south and west is made up with spoil from the excavations, forming a site for shipbuilding and engineering works. Land, on the south-east, is reserved for slipways, and is formed with a slope down to the frontage wall, then kept low for the purpose of launching vessels over it into the river. Simultaneously with the construction of the docks and basins, the river frontage wall and entrance have been constructed for the Mersey Docks and Harbour Board, who own the land, for the use of the Company during their possession of it. The new works were commenced in January, 1903. Tidal

TRANMERE Outer Basin


MESSRS CAMMELL LAIRD & CO'S BIRKENHEAD & TRANMERE SHIPYARDS.
SCALE 1/2500
GRAVING DOCKS
No. LENGTH. BREADTH. WATER ON SILL AT H.W.O.S. DEPTH.
1 360.0 75.0 25.0
2 360.0 75.0 25.0
3 448.0 75.0 25.0
4 730.0 80.0 30.0
5 730.0 80.0 30.0
6 808.0 80.0 30.0
7 881.0 90.0 33.0
NEW CHESTER ROAD
CHESTER ROAD
RIVER MERSEY
OUTER BASIN
GRAVING DOCK No 7
GRAVING DOCK No 6
GRAVING DOCK No 5
GRAVING DOCK No 4
GRAVING DOCK No 3
GRAVING DOCK No 2
GRAVING DOCK No 1
INNER BASIN
SOUTH MACHINE SHOP
NORTH MACHINE SHOP
BOILER SHOP
SMITHY
JOINERS SHOP
PATTERN STORE
TIMBER STORE
SAWMILL
CHURCH STREET
ABBEY STREET
WHITE STREET
PILGRIM STREET
MONKS FERRY
TO WOODSIDE FERRY
TO MONKS FERRY
HELSBY LANE STN
WIRRAL RAILWAY

influences were overcome by means of three dams linked with short lengths of permanent river wall. On March 14th, 1904, the reclamation works were sufficiently complete to exclude the tidal waters. Two large sewers, which discharged into open channels on the foreshore, had to be dealt with. The Green Lane Sewer was made permanent by the construction of a cast-iron pipe, 5 ft. 6 in. diameter in a bed of concrete. The Grange Vale Sewer Culvert is also of circular section, 6 ft. 6 in. in diameter. The two graving docks are situated at the extreme north of the new works. The quay space between the coping lines of the docks is 44 ft. 4 in., and between the coping line of South dock and basin, 64 ft. 8 in. The centre lines of the docks are at an angle of 64 degrees, with river wall and point up stream. The inner face of sill to head of the No. 1 or North Dock is 708 feet. Length of keel block, 660 ft. Width at coping level, 110 ft. 2 in.; at sill level, 80 ft., equal to entrance. Width on floor, bed 6 ft. 8 in. wide and 15 in. deep, and are 2 ft. 6 in. apart between centres. Graving Dock No. 2 has a rudder pit 50 ft. long and 14 ft. deep. The pumping machinery consists of two centrifugal pumps, 45 in. diameter, direct-driven by vertical compound engines and one 14 in. pump, with independent engine, for draining docks. The pumping station, which also contains an air-compressor for working the penstocks and dynamos for lighting the pier heads and graving dock sides, is situated between the docks at the river end. Underneath is the deep-level suction chamber, into which the suction pipe of the pumps descend through shafts in the rock. The suction chamber itself is 26 ft. long by 12 ft. wide by 15 ft. high to the soffit of the arched roof. Two suction culverts, 7 ft. diameter, lead from the chamber to the drainage wells of the docks. Both pumps discharge into one delivery culvert 5 ft. 6 in. diameter, whose outlet is in the pier head between

TRANMERE Main Machine and Erecting Shop

71 ft. Level of sill, 12 in. below datum, giving a depth of 30 ft. 10 in. at high water of ordinary Spring tides. South No. 2 Dock is 861 ft. long from inner face of sill to head; it is 10 ft. wider than No. 1, namely 120 ft. 2 in. on coping, 90 ft. at sill level, 81 ft. on floor and 3 ft. deeper, thus affording depth of water over sill of 33 ft. 10 in. at high water of Spring and 26 ft. 7 in. at high water of Neap tides. Both docks have other dimensions the same. Each has a torpedo-head on the vertical walls of which the altar die out as the curve strikes them. Each is provided with four timber slides, flanked with two flights of steps, two piercing each wall. These are inclined at an angle of 45 degrees, and are arched over for a width of 15 ft.; the top of the altars and coping are continuous. The chief feature of both docks as regards construction, is that the floors and altars, where possible, are cut and dressed from the red sandstone, each without any facing of masonry or concrete. The floors have had to be concreted. Excavation for No. 1 Dock was almost entirely in rock. Keel blocks rest on a continuous concrete docks. The specified duty was 1,650,000 cubic feet, sufficient to empty the larger dock below mean tide level in two hours. Both of the entrances are designed to take ship caissons which settle into grooves and are towed clear. Electric and hand capstans are provided on pier-heads, as well as a system of Bollands. A 15 in. centrifugal pump, with direct compound engine, is fitted on main deck, which will lift caissons clear of grooves in fifteen minutes. The outer floating basin is entered directly by the entrance from river, 91 ft. 6 in. and 30 ft., being closed with a pair of Greenheart gates. The sill of main entrance is 15 ft. below datum, giving 33 ft. 10 in. at Spring and 26 ft. 7 in. at Neap tides. The small ditto has its entrance 12 ft. 6 in. higher. The Basin is excavated to 20 feet below datum, giving a depth of water of 30 feet. The walls form quays for repairing and fitting-out of vessels, and are respectively 1000, 850 and 990 feet in length. The inner basin is intended for barges and light-draught vessels. It is excavated to 2 ft. below datum, giving a depth of water 13 ft. 7 in. at high water

150 Ton Crane, launching Paddle Steamer.

Tranmere Large Dry Dock

of Neap tides. An entrance 40 ft. wide, spanned by a swing bridge, connects this with the outer basin. The river wall is built up to 11 ft. above datum, or 7 ft. 10 in. below high water of Spring tides, and forms a frontage to the launch ways, which rise behind it at an inclination of ½ in. per foot. These are formed of rock rubble tipped on to foreshore. A concrete platform 40 ft. wide by 5 ft. thick, supported by three rows of bearing piles, under the lines of keel blocks and ground ways, is laid for a length of 400 ft. up from river wall. Above this the piled foundation runs under keel blocks alone. For a length of 50 ft., *viz.*, in the region where a concentrated load may be expected, due to the stern being first water borne, the piling is doubled. Four other launch ways have been piled. The slips vary from 700 to 1000 ft. in length.

The equipment of the docks is in accord with their intended use, *viz.*, outfitting and repairing. A 40-ton electric crane travels along the quay space on the south side of No. 2 Dock, serving that dock and the north side of outer basin. A 150-ton crane is installed on the South Quay of the outer basin, adjacent to the Main Engine Shops. This crane has a derrick jib and revolves on a pivot pier and three stay piers, the whole structure being of steel lattice work. Track for 10-ton steam crane runs along the north side of No. 2 Dock, along both sides of No. 1 Dock, and along the quays of the inner basin. 10-ton electric capstans are provided at the head of each graving dock and at pier head. Two 5-ton capstans stand on the outer pier heads, and two 3-ton capstans (electric) midway along the sides of the docks. Hand capstans are also provided on each pier head. Mooring posts are fixed at 80 ft. intervals along all the walls. Electricity for working the cranes, capstans, and gate-opening machinery, for lighting the shipyard, and for motive power in the shops, is furnished by a generating station at the south-west corner of the site. A gas-producing plant consisting of three producers, with the attendant washing, scrubbing and drying plant, is here installed. Seven gas engines of 2350 H.P. are linked with dynamos generating 1300 kilowatts. An air compressing and hydraulic plant is also installed. The power-house is 275 ft. long, 38 ft. wide inside, roofed with glass and fitted with a travelling crane.

The shops are to the south and west of the outer basin. They are of steel framework, roofed with glass and corrugated sheeting, with sides of the latter material. The ground being made, the columns of these buildings having to support travelling cranes, are built on groups of four to twelve Simplex Concrete piles. The main Erecting and Machine Shop is 1075 ft. long, with travelling cranes 60 ft. above floor level, the centre portion being 74 ft. span.

About 64,000 cubic yards of material was dredged out of river bed to provide deep water access to the docks. Water was admitted to the docks and basins on April 9th, 1906, two years after the reclamation of the site was effected.

A system of large dry and wet docks is so dependent upon the plant adjacent to them for the discharge of their functions that a brief description of the Tranmere shops and tools may be of interest. The main Engine Erecting and Machine Shop on the south side of the outer basin is, as before mentioned, 1075 ft. long by 77 ft. wide in the main bay, while the two side bays are 610 ft. long by 42 ft. 6 in. wide. The main bay has two 70-ton cranes, with lifting speeds of 5 and 10 feet per minute with 70 and 35 ton loads respectively. Travel 150 ft. per minute and traverse of 75 ft. per min. Also two 20-ton cranes. The North Bay having one 35 and one 10-ton cranes, and the South Bay is now being similarly equipped. This bay has also a gallery for light machines, tool, jig and millwrights' stores, tool-making shop with 5 cwt. pneumatic hammer.

The Turbine Blading Department is at the east end of the shop, which also contains the Testing Department, where all cylinders, valves, etc., are tested per square inch. The shop is heated by six separate engine-driven sets, of the Sturtevant make, the contents to be heated being 12,000,000 cubic ft. All the shops are lighted from the Power Station already described. The Boiler Shop has a main bay 500 ft. long and 80 ft. wide, the side bay being 421 ft. 10½ in. long and 50 ft. wide, while a new extension is 80 ft. by 46 ft., the whole shop being equipped with some of the latest and largest machines to be found in this country. The Copper Shop is 315 ft. long and is equipped with pipe benders, rapid guillotine shears, pneumatic hammers, etc. The Shipbuilding Sheds have three bays, one of 442 ft. 9 in. and two of 385 ft. length, the middle bay being 120 ft. wide. Amongst other machines in these sheds may be noted, radial drills, plate edge planes, countersink drills, multiple punches, horizontal and vertical plate-bending rolls and various hydraulic manhole punches, beam benders, punches and jogglers, etc. The Angle Smithy is 210 ft. by 114 ft. wide, and has installed a 40 ft. edge planer, cold saw mast rolls, radial drills, etc. The Shipyard Smithy adjoining contains also a fitting shop, each having a bay 210 ft. by 70 ft. wide. This smithy has pneumatic and steam hammers. The Mold Loft, Stores and Spar Shed is 280 ft. by 70 ft., is west of the Main Ship Sheds. The Spar Shed is supplied with hydraulic bolt forcer and hole borer for hatches, and a 36 in. saw and surfacing machine. At the centre of the yard, to the west, lie the Saw Mills, with two bays 200 ft. long and 55 ft. wide; brick sides with iron columns in centre fitted with 4-ton cranes. The Joiners' Shop lies to the west and is 300 ft. by 100 ft. wide, and is constructed with bays, is lighted with glass skylights and heated with a Sturtevant Plant. A Joiners' Store, Electricians' Workshop, with ship-draughting office over, lies to the north of the main Joiners' Shop, and is 300 ft. by 60 ft. wide. Seven cranes lifting up to 5 tons, and length of gib up to 28 ft., are placed in various parts of the yard, while, for the construction of the Floating Dock four cranes of 5 tons, with jibs of 45 ft. are installed, by J. H. Wilson. Railways are laid throughout the works, these are served by three locos, and large three-storey General and Drawing Offices are situated near the Church Street entrance.

"REFRIGERATED CARGOES AND THEIR INSURANCE."—A paper on this subject was read recently before the members of The Cold Storage and Ice Association by Mr. C. E. Brightman. The general subject of insurance from the historical side was dealt with by the author, who then recalled the days of the first ventures to import frozen produce. The first consignment of 400 carcases of beef and a quantity of mutton was brought by the Anchor line s.s. *Circassia* from New York. The first shipment of frozen mutton from Australia was brought to London in 1880, followed by another from New Zealand in 1882. The refrigerating system was by the Bell-Coleman compressed air process. Continuing, it was pointed out that in 1899 the number of chilled beef carcases imported amounted to 1,654,000 from North America, and in 1909, the number was 1,587,134, the greater portion coming from the Argentine, 1,066,134, the remainder, from North America. Frozen beef in 1899 amounted to 530,736 quarters, Australia sending 346,464; New Zealand 86,255; and America 98,016. In 1909 the frozen beef imports rose to 2,157,000 quarters, South America sending 1,590,085, the remainder coming from Australia and New Zealand about equally. The total imports of mutton in 1909 were:—South America, 2,718,715 carcases; New Zealand 1,869,599; Australia 1,327,141; of lamb, New Zealand sent 3,165,504 carcases; Australia 1,351,697; South America 634,496. The value of all dead meat imported annually probably reached the total of £41,500,000. The importance of insurance policies dealing with such an enormous value was apparent, and the different classes of, and clauses in, policies were enumerated and discussed, the average rate for all risks being quoted as 32/6 to 35/- per cent. in the River Plate trade. The closing part of the paper dealt with damage claims and inspection of carcases with a view to settlement of value due to slight damage, arising from misshapen carcases, chafing, staining by being trampled, by coal dust, by inefficient handling in transit from the freezing works, or by rushing the freezing process and getting delivery surreptitiously in the darkness; some of these causes were more implied than named, and the author urged that every one connected with the trade should do his utmost to prevent abuses and maintain a high standard of right and duty in preparing, shipping, receiving, carrying and delivering carcases until they reach the retail dealer.

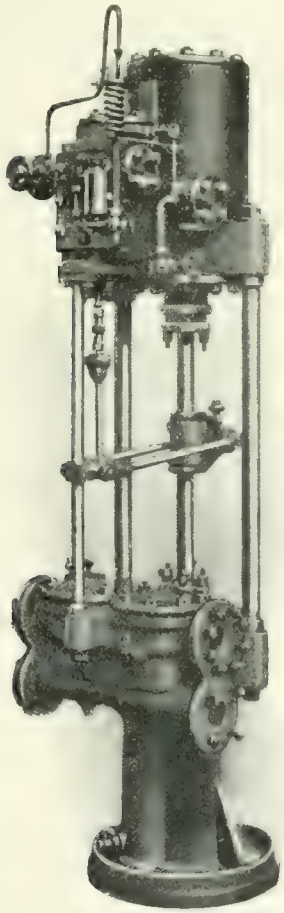
THE "WARATAH."—A most exhaustive enquiry is being conducted at Caxton Hall, Westminster, into the loss of this vessel, which left Durban for Cape Town in the course of a voyage from Australia to England on July 26th, 1909, and not heard of since she was spoken by a steamer on the following day.

NEW BOILER FEED PUMP.

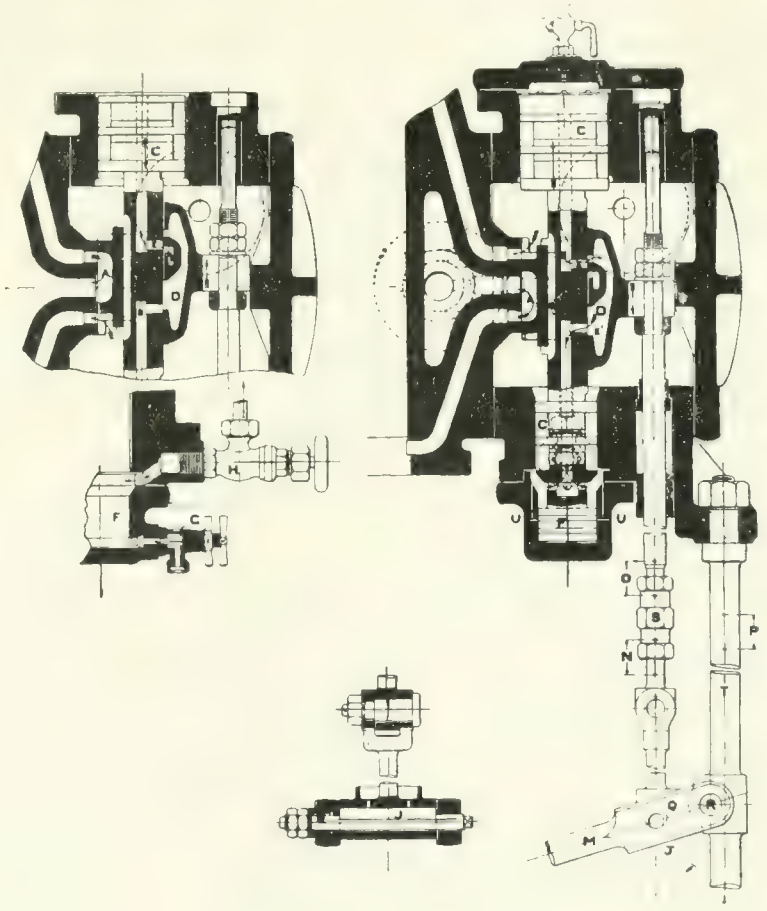
Storey & Hallowell's Patents.

AS intimated in our recent notice of the Machinery Exhibition, at Manchester, we inspected there a Boiler Feed Pump, of a new type, which appeared to have several distinctive features, and we now illustrate same by an outside view, and enlarged section. It will be seen that the arrangement consists of a new form of valve gear, in which flat valves are employed, and thus the leakage of steam which ensues from the wear of cylindrical valves, is avoided. Moreover, the difficulty of renewal is surmounted, valves having flat faces keep tight, even when seriously worn, and the face can be scraped up again under almost any circumstances, either at sea or on shore. The slide valve controller pistons, it will be seen, are fitted with spring piston rings which take up their own wear and the life of which may be compared to ordinary engine piston rings. Thus it will be gathered, the design is intended for trying conditions like those experienced in marine work. When we turn to the question of steam economy, it is claimed by the makers that this design secures a great advantage over the ordinary type of shuttle valve usually employed in direct acting pumps. The stroke of the controller in the "Storey" pump corresponding with one double stroke of the pump piston, is effected with but one charge of steam in the controller cylinder, as against a charge at each end in the case of the shuttle valve, and this, of course, gives a very considerable economy in a pump working a day and night service constantly. There is also no dead point, and therefore at whatever point it may have been stopped at, the pump can be started instantly, there being, it is observed, no lost motion between pump and valve rod. Another feature is, that whatever the speed of pumping, a full stroke is always made, the action of the gear being positive at any speed, and therefore there is no short stroking. The fullest efficiency is thus obtained from the steam.

To describe the system in detail, by following the lettering, A is the main valve controlled by B, with its two pistons CC', working in small cylinders at each end of the steam chest, to which the inner end of each is open while the outer face of the smaller piston is in direct communication with the exhaust. When the larger piston is balanced by full pressure being admitted to the outside, the controller B and main valve A are moved by the steam acting on the inner face of the smaller piston. The movement of the main valve in the opposite direction is obtained by placing the outer face of the larger piston in connection with the exhaust, when the steam pressure, acting on the different areas of the two pistons, moves the controller in the required direction. In the right-hand view the piston of the main steam cylinder, and with it the auxiliary slide valve D, have reached the bottom position, the outside of controller piston C being opened



Outside View.



Enlarged Section.

to exhaust by way of a passage in slide valve D, the port E^1, and finally to atmosphere through the adjustable valve H, causing the valve to move upwards. With the movement of the controller B, and with it the main valve A, steam is admitted to the lower side of the main pump piston giving the upward stroke; the position of the controller at the end of this stroke is seen in the left-hand view showing the outer side of piston C cut off from the exhaust by the motion of the slide valve D, which has just opened the port E to steam. Full pressure now acts on both sides of piston C, thus putting it into balance, and the controller is moved downwards by the pressure on the inside of lower piston C, and the main valve then admitting steam to the top side of the main piston, the cycle of operations being afterwards repeated.

The controller is cushioned at the end of each stroke:—by exhaust steam at the top, and the air dashpot F at the bottom, a snifting valve G being fitted. The cushioning downwards being also assisted by the steam supply to the top side of piston C being cut off before the end of its stroke and causing it to work expansively. By carefully adjusting the exhaust throttle H and the snifting valve G, silent running is ensured. The auxiliary valve D being coupled through the levers to the pump rod is always in a position to allow the steam to enter or exhaust from the controller cylinder C and move the controller and main valve. It is therefore impossible to put the pump in a position it will not start from directly a sufficient pressure of steam is admitted, and thus the pump has no dead centre. Adjustments of every kind are provided for and all the valves may be removed for inspection when the valve chest cover is taken off.

The correct stroke of the pump is obtained by adjusting an eccentric pin J in the lever M, and for the auxiliary slide valve spindle by the right and left-hand screwed sleeves. If there is not an equal stroke at both ends of the pump this can be corrected by throwing over the auxiliary valve D in the opposite direction to that in which the short stroking takes place by means of the sleeve S. The stroke may be lengthened equally at each end by turning the pin J towards the fulcrum R of the lever M. The United Brassfounders & Engineers, Limited (Isaac Storey & Sons, Limited, Branch), are the sole makers of these pumps.

MESSRS. HEATH & CO., LTD.

The well-known firm of Messrs. Heath & Co., Ltd., of Crayford and London, are issuing a special catalogue dealing with their latest patented Standard Binnacles, which they are anxious to put into the hands of shipowners. This catalogue illustrates Binnacles suitable for every type of vessel, from the largest to the smallest, and embraces all their improvements to date, also Sounding Machines, which are made to the Kew standard. There is no doubt that a glance through these lists will prove of great service to those drawing up specifications for new ships or replacements. There is no doubt that the instruments made by this firm are of first-class manufacture, as all their "Hezzanith" instruments are guaranteed. Those interested should make application at once for this useful book of reference. The firm issues seven large catalogues: No. 1, Sex-tants; No. 2, Binnacles and Compasses; No. 3, Barometers and Clocks; No. 4, Logs, Sounding Machines, Lamps, etc.; No. 5, Thermometers and Thermographs; No. 6, Survyeing Instruments; No. 7, Mathematical Instruments and sundries. Messrs. Heath & Co., Ltd., have been established at Crayford and London, since 1846, and are contractors to many of the Governments.

LARGE HATCHWAYS.

NOTHING expresses with more clearness the enormous development which has taken place in the arrangements for loading and discharging cargo steamers than the rapid and progressive increase which has taken place in the size of cargo hatchways. In quite recent times the enormous apertures that now yawn in the decks of some particular types of ships would have been considered to be in the nature of an experiment of great gravity. The hatchway, to the naval architect, is the vulnerable part of a vessel's deck, the point of attack upon which any attempt to impair the seaworthiness of the vessel is delivered, and it would have been argued that to extend the area of this vulnerability would be reprehensible in the extreme. For a long time the maximum dimensions of a cargo hatchway were considered to be about 24 ft. × 16 ft., possibly because that was the maximum length provided for in the Rules of Lloyd's Register. Of late years, however, the necessity for rapid loading and discharging, for effecting economy during the former process by saving labour in trimming, have led to a great expansion of these dimensions, until now, in small coasting steamers it is not unusual to see hatchways 36ft. in length and of a width that only allows of 5 ft. of deck plating being left at the sides. In some special cases indeed, hatchways about 80 ft. in length have been fitted.

Now it becomes a very interesting question to the practical naval architect to investigate the effect of these and other changes (due, in the main, to the compulsion of modern conditions) on the structure of the vessel itself, and these investigations open up a very wide and complex field into which it would not be proper to enter fully here. For example, it has been found necessary in ships engaged in the coal, ore or timber trade to take one or two bulkheads out in some instances. What effect has that on the structure? Well, it is quite evident that such an omission decidedly impairs the seaworthiness of the vessel in certain eventualities. But in estimating its effect upon the strength of the structure, the enquirer must solve a problem of great intricacy, as anyone may see who will make himself acquainted with Dr. Bruhn's solution of it given in a paper read recently before the Institution of Naval Architects.

In the case of large hatchways, however, we may offer some general considerations, first of all affecting the structure itself, and secondly, affecting the hatchway in particular. In order that the position may be clearly understood, a sketch is appended (Fig. 1) of a vessel about 250 ft. in length showing the arrangement of the deck in outline. At the same time the position and dimensions of the normal hatchways have been indicated in dotted lines.

It will be seen that the hatchways extend to within about 5 ft. of the vessel's side, so that almost the whole of the deck is cut away. The part of the deck now effective for longitudinal strength is represented by this 60″ of stringer plate, and in addition, for the length of the hatchway—say 40 ft.—this stringer plate must take part of the horizontal thrusts on the vessel's side, since there are no through beams. For both these purposes it is necessary to increase the thickness of the stringer plate, and this is made usually in one

plate and about $\frac{12}{20}$" in thickness. Again, it is evident that with hatchways of this size it is quite impossible to fit pillars in the hold at the centre line to support the deck, since there is, for a considerable part of the vessel's length, nothing to which they can be attached at the head. In order to get over this difficulty and also that the stringer plate may be made efficient as a local and structural girder by being held rigidly to its work, deep brackets are fitted to every fourth frame in way of the hatchways, as shown in the section. Now, although this arrangement may be tolerably effective in supporting the deck and also may operate in the direction of decreasing the stresses in the frames, yet it cannot be so efficient structurally as a row of pillars. Pillars not only support the deck loads, but they form a fairly efficient tie connecting the top and bottom of the vessel. In the case we are considering this is entirely wanting and a good deal of structural rigidity

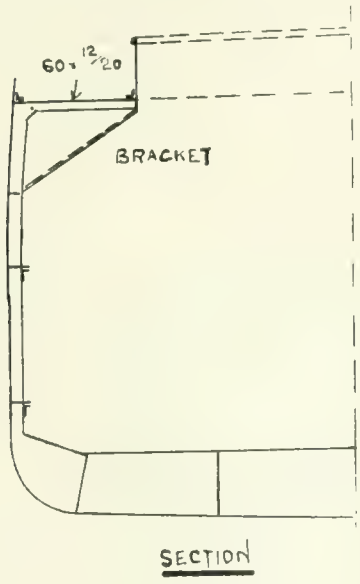


Fig. 1.

is lost in consequence. The small amount of deck left between the hatchways is utilised as a winch platform and is generally supported by one or two pillars at the centre line, or by fore and aft brackets from any transverse bulkhead which may be fitted in its vicinity. The efficiency of this stringer plate as a local girder can be determined by assuming certain conditions of pressure, and by considering the transmitted reactions of the frames at their upper extremities as a distributed load. It will be found that even under severe conditions of loading the stress on the stringer plate is relatively low, but it should not be forgotten that this is to be compounded with a structural stress not much below the normal. If compared strictly with the vessel having ordinary widths of hatchway it will be found that the stringer plate will require to be made of substantial thickness to obtain equivalent strength. In vessels of extreme proportions this arrangement means another factor to be reckoned with, and even when all precautions are taken it is hardly possible to say to what extent increase of stress takes place at points of decided change of section, as at the corners of the hatchways. This is usually minimized as far as possible by fitted substantial doubling plates joining up the hatch corners, or in some cases the hatchway coamings are made continuous from the bridge front, cut down a little between the hatchways to allow for battening. Taking the arrangement generally, however, it can safely be said that from its very nature, it cannot be made entirely satisfactory as regards structural strength.

Now it is most important that, having such large openings in the deck, these openings should be properly framed, and that more than ordinary care should be exercised in designing the coamings, the wooden covers and the supports for the latter. In respect of the hatchway coamings these are usually formed of steel plates in the usual way, $\frac{10}{20}$" in thickness. In addition, however, it is most desirable that, if the deck will at all allow of it, they should be additionally supported by closely spaced brackets attached to the deck. If this is not possible, then the hatch slide bars on the inside should be made of substantial bulb angle section and should be extended to the bottom of the coaming. These precautions are amply justified by the conditions. As regards the method of supporting the covers there are two in common use. The first is by means of transverse beams, fitted between the coamings about 10 ft. apart, associated with fore-and-afters of bulb angle or bulb tee, the hatch covers being laid athwartship. The second method, largely, we believe the result of a Home Office regulation, dispenses with fore-and-afters altogether and consists of a series of transverse webs fitted about 5 ft. apart, the hatch covers being laid fore-and-aft. Now, as usually fitted, there is no correspondence between the two arrangements, and we strongly advocate the latter as being the more efficient. In the first place, since the fore-and-afters give up half their load to the webs, it will be evident that a greater *proportion* of the load on the hatchway is borne by the webs in the first method than by those in the second. It is possible also to know what load *is* incident on the web in the second case with a fair amount of certainty, while in the former case it is not so possible. An example will make this clear. Let us take a hatchway of a width to require three fore-and-afters only; the arrangement would be as shown in section (Fig. 2) appended. Assuming no deflection of the fore-and-afters A and B, the load on the hatchway, W, can easily be shown to be at C or B $\frac{3}{16}$ W, or at A $\frac{5}{8}$ W if the hatch cover be considered flexible. This would involve A being stronger than B, but it is generally much less strong. The rigidity of the cover (3-inch thick), however, cannot be neglected, for it is very considerable, and if it be taken into account and the load on the hatchway be apportioned between the supports in proportion to their stiffness and that of the cover, it will be found that the load borne by A can be neglected. When it is remembered that we have no guarantee that there is no sag in A,

it will be evident, in view of the above, that A's presence is unnecessary; A, in short, could be dispensed with, and if the thickness of the hatch cover is not sufficient at 3-inch (which is very unlikely) it could be slightly increased. The arrangement would then be determinate and a good deal simpler. The same remarks apply in a rather more limited

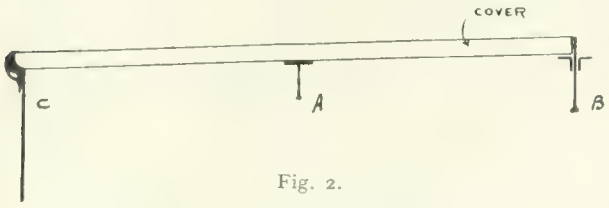


Fig. 2.

way when two fore-and-afters are fitted on each side of the centre. It is by no means certain that these are necessary; and even if they are held to be necessary, it is quite impossible to know what amount of work each one is being called upon to perform. For these reasons, among others, we suggest that fore-and-afters should be dispensed with, and that the hatch covers should be supported by webs only.

THE SIMPLEX TUBELESS SUPERHEATER.

THE interest aroused of recent years in the use of superheated steam and the advantages that have accrued therefrom have given an impetus to designers for improving the construction of such devices. It has been customary in the past to arrange the heat-absorbing elements of the device of tubular construction, which of necessity must be of very light scantling, with serious difficulties as to inspection, cleaning and repair. The Simplex Patent Tubeless Superheater Co., Ltd., of 39, Victoria Street, Westminster, have brought out a Superheater, which we now have the pleasure of illustrating and describing. It has been designed to supply dry steam without entailing in its construction any arrangement of tubular elements, or in fact any detail to which any practical man could offer any serious objection. Figure 1 is a longitudinal vertical section of a superheater constructed for installation in the smoke box of an ordinary Scotch boiler. Figure 2 is a transverse section of the same. Figure 3 is a part sectional plan and part plan showing the inspection doors. Figure 4 shows the application of this principle to the Marine boiler. It indicates an alternative method of fixing the diaphragm by means of long rivets passed through ferrules. In this case the diaphragms are flat plates and not channels.

The special feature of this tubeless Superheater is the formation of a chamber of steel boiler plate and the staying of the large flat sides by means of channels riveted to each side and arranged to provide a passage alternately at the top and bottom of the chamber, so that the steam entering at the branch at one end passes in a zig-zag path through the superheater and is kept for a considerable time in touch with the hot plates. Ample provision is made for internal examination and cleaning by means of an inspection hole at the top of every compartment except the end ones which are provided with mud doors. It is interesting to note, however, that after one of the Simplex Superheaters had been in continuous use for over two years it was found, on examination, that there was nothing to clean out. It would appear to us that the immunity from tube trouble to be obtained by this superheater and the robust simplicity of its design should readily attract the attention of steam users, and there seems a great probability that a device of this character is likely to take the place of many existing tubular superheaters on the above grounds alone, quite apart from any question of relative efficiency within moderate limits. It is well known that a large number of steam users have tried tubular superheaters and have scrapped them owing to trouble with the tubes.

REFRIGERATING APPARATUS FOR MARINE TRANSPORT.

THE transport of produce of all kinds overseas has developed enormously during the last forty years or so, and it may fairly be claimed that the trade has been of very great benefit to the bulk of the community of the United Kingdom. The man of wealth, the man of even comparative affluence can enjoy the fruits that are grown in the Tropics, and those that are grown in temperate climates, at all times of the year, if he wishes to. We are now no longer dependent upon the farmer, or the cattle, sheep or poultry breeder for our supplies of meat, poultry and eggs. They come to us in ever-increasing quantities from all parts of the globe, and they come in ships that are specially fitted for their transport.

The methods of handling produce, and of fitting ships that are to carry produce, have also developed and improved very largely during the last forty years. As in so many other cases, the early efforts were somewhat crude. The importance of thermal insulation was perhaps hardly realized in the early days of the transport of produce by the aid of refrigeration. The importance also of selecting the produce that is to be carried, and of handling it carefully, of seeing that it is not damaged, were also not realized in the early days. Experience, the hard but very perfect teacher, with whom marine engineers probably more than any other profession have a very intimate acquaintance, has taught its lessons in its usual painful way. Though the methods of transport are even to-day not as perfect as they might be, though there are still complaints of the manner in which some kinds of produce are handled on arrival at the ports of the United Kingdom, and though there are still complaints that the produce is not always as carefully selected where it is grown as it should be, things are steadily improving, and the keen competition that now exists for the market of the United Kingdom, between our own colonies, the United States of America and the Argentine, is producing the usual results. New Zealand, among our colonies, has taken the lead in watching the animals that are to be transported by ship, from their very birth. Trained inspectors are constantly going round the stations where sheep and cattle are grown, rejecting any animals that are not up to standard, the owners being compensated for the loss. They are constantly going round the slaughterhouses, and they follow the animals right to the ship's hold. As far as possible, also, representatives of the New Zealand Government follow the consignments on their arrival in the United Kingdom. What New Zealand has done voluntarily, our other colonies and the other competitors for our trade have been obliged to do under the keen stress of competition.

Improved Methods of Holding Produce.

With the increase of experience, improved methods of holding produce have been worked out. In the early days the beef that was transported from the United States of America to this country, was practically chilled by means of ice. Later on it was frozen. Later again, it was found that frozen beef deteriorated to such an extent, owing to the fact that the vessels containing liquids in the carcases of the animals,

Fig. 1.

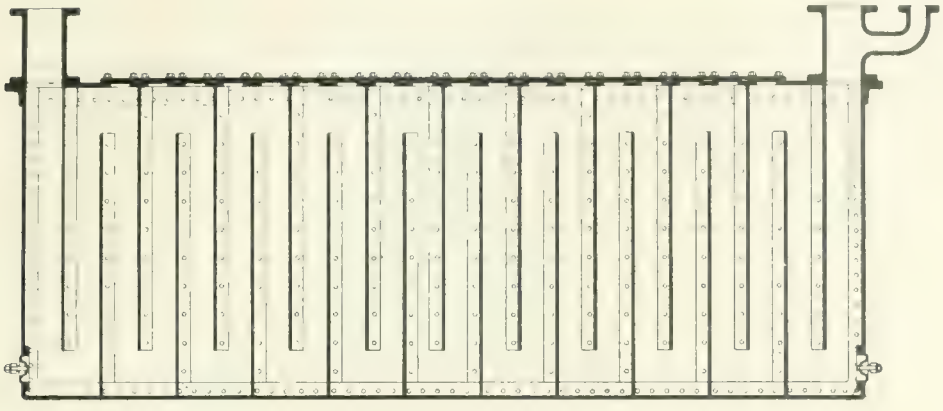
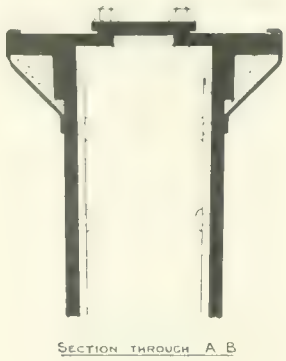


Fig. 2.



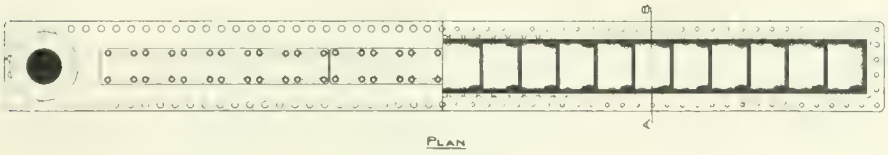


Fig. 3.

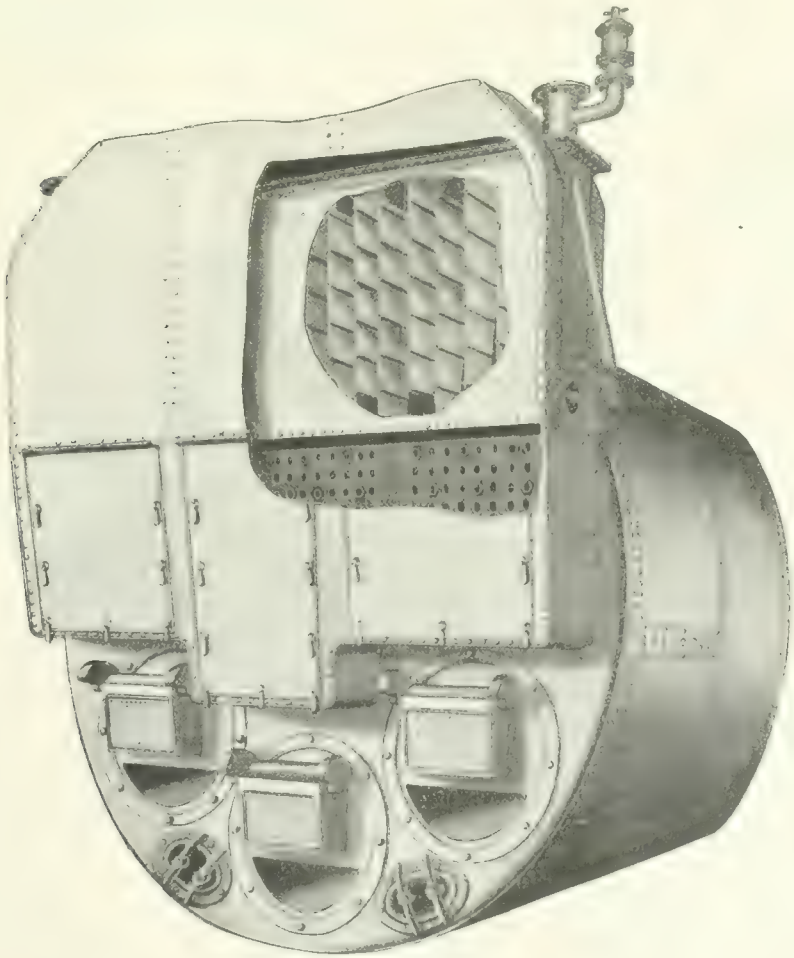


Fig. 4.—Simplex Patent Tubeless Superheater as fitted to a Marine-type Boiler.

were so compressed when frozen, that the meat on arrival fetched 3d. to 4d. per lb. less than that which was only chilled. Now more and more beef arrives here in the chilled condition, and less and less frozen, and again still less alive. A little consideration will show that the meat from a well-grown bullock, slaughtered while in good health and under proper conditions and in a proper manner, properly cooled and chilled, and transported in the chilled condition to this country, properly handled on arrival, must be better, more nourishing, than the meat of a similar animal, no matter how well grown, that is exposed to the necessary rough treatment of a cross-Atlantic voyage, and slaughtered on arrival. Chilled beef was first transported from the United States only ; later on improved methods of refrigeration and faster steamers enabled it to be transported from the River Plate ; and within the last few months a consignment of chilled beef has been carried from Queensland to the old country with success.

The same lessons that have been learned in connection with meat have been also learned in connection with fruit and every other kind of produce. A great deal still remains to be learned, but sufficient is known to enable a large and profitable trade to be done.

The Difference between Chilling and Freezing.

With a large number of substances freezing is forbidden. Fruits for instance, are spoiled by freezing. The expansion of the juices of the fruit during the process of freezing, so damages the fibres and the body of the fruit, that it is not worth eating when thawed out. Other substances, such as mutton and lamb and butter, apparently may be frozen without material injury. Others, again, such as beef, cheese and certain others may be frozen, but are worth more on arrival if not frozen.

The difference between freezing and chilling is a very simple one, but the skill and care required to carry out the process of chilling is very much greater than that required for freezing. With freezing, the atmosphere surrounding the substance is reduced to a certain temperature, a good many degrees below the freezing point of its own juices. It should be mentioned here incidentally, that the freezing points of the juices of the fruits, meats and other produce, is not the same as the freezing point of water. The freezing point of pure water varies with the pressure, but 32°F., or 0°C. may be taken as sufficiently accurate for practical purposes. Immediately, however, that any substance is dissolved in water, the freezing point of the solution is lowered. As explained later on in these articles, advantage is taken of this fact, to enable indirect methods of cooling to be arranged, instead of direct methods, the latter having certain disadvantages that will also be explained.

With chilled produce the juices of the produce are never frozen. Beef, for instance, is kept at a temperature of 33° to 34°F., and fruits at somewhere about the same figure ; that is to say, a few degrees above freezing point. It is of far more importance that the temperature shall not reach the freezing point, and that no part of the produce shall be frozen, than that the temperature shall rise during the process of transport. As will be explained later, the ships that are engaged in transporting chilled beef, and what is practically chilled fruit, have careful arrangements provided, under the control of the refrigerating engineer, so that the temperature is kept practically at the figures named, in every part of the hold, or the cold store where the produce is carried.

What is Necessary for Holding Produce in Cold Store.

There are two distinct operations required for the preservation of any kind of produce. First the produce, no matter what it is, must have its temperature lowered to the figure at which it is to be held while in the cold store. After this has been accomplished, the heat which passes into the cold store, through the insulating walls that will be described, and that may reach the produce from any other source, has to be extracted and delivered, in the case of board ship work, to the water in which the ship is floating.

The operation of lowering the temperature of the produce is by far the more important of the two, though as usual in in matters of this kind, it is necessary that both operations shall be very carefully carried out, and that the removal of heat that penetrates into the cold chamber shall go on continuously during the whole period the produce is held there.

The important thing to remember in the matter of lowering the temperature of the produce is that it must be done gradually. In all produce, if a very low temperature be suddenly applied, the outer skin, or rather the juices contained in the outer skin, and outer layers of the substance of which the produce is composed, freeze, or at any rate form a jacket, which encloses the remainder of the substance, the inside portions being at a higher temperature, and decay being readily set up. The case of meat is perhaps the most instructive. With all kinds of meat, whether it is to be chilled or frozen, after killing, what is termed the animal heat is first allowed to escape. In the slaughterhouses, which are attached to the large establishments that now cater for the wants of the United Kingdom, in cattle and sheep, killing goes on very quickly, the beasts or sheep, or pigs, succeeding each other in front of a line of men, as quickly as the men themselves can perform the different operations necessary. The animals are killed, skinned, the entrails, the head and other portions removed ; cattle and pigs are divided in halves and cattle usually into quarters, all this being done by men detailed for the purpose, as each animal passes along the line. After the killing and subsequent operations are complete, the carcases, halves or quarters of the animals, which have been hung by hooks from an overhead travelling rail, such as may be seen in large butchers' shops in most towns of the United Kingdom, are run into what is called the cooling-room, where they are subject to a draught of dry air, not at too low a temperature. In the cooling-room the animal heat is allowed entirely to escape, and the body of the carcase is lowered to a temperature of about 80°F. The carcases are then transported to the chilling or freezing-room, the overhead track rails mentioned above being made continuous through the killing, the cooling and the chilling or freezing rooms. In the chilling or freezing rooms, they are subject to a draught of colder air, the temperature of the meat being gradually lowered to the figure at which it is to be held. The gradual lowering of the temperature, as explained above, is of the very utmost importance.

From the chilling or freezing rooms at the killing station the carcases are transported in trucks specially built for the purpose, and thermally insulated, to the shipping port, where they are loaded into the different holds.

There is a considerable difference in the treatment of mutton, lamb and beef, as partially explained above. Mutton and lamb, up to the present, have always been frozen, and are held usually at a temperature of about 17°F. That is to say, the temperature of the atmosphere of the cold stores in which they are carried, is held at that figure. The carcases of sheep and lambs are usually also encased in what is sometimes termed a shirt. It is a coarse linen bag, which performs the double office of protecting the meat from dirt and mechanical injury and of carrying the marks of the exporter and importer. Beef which is frozen is handled in very much the same way, the frozen quarters being usually wrapped in sacking, which also carries the marks of the exporter and importer. Chilled beef is usually not wrapped at all. It is suspended from hooks carried by travelling overhead railways in the holds of the ships, very much on the same lines as those in the cooling and chilling rooms at the killing stations.

The process of lowering the temperature of fruit and similar produce is very much the same. Some fruits, such as apples, peaches, plums, etc., are wrapped in soft paper, and carefully packed in boxes or barrels provided for the purpose. Other fruits, such as bananas, which are transported in the very large bunches in which they grow, are merely stacked up loosely in stalls provided for them in the refrigerated holds of the ships. In either case, the fruit is exposed to a draught of dry air, the temperature of which is gradually lowered, till the fruit is at the desired figure. As explained above, care of the fruit is of the very utmost importance in the matter of cold storage. Bruised fruit should never be carried into store. A bruise means the commencement of decay, and the bacilli which are formed in the process multiply very quickly, and the surrounding fruits will probably be inoculated. It has often happened that one bad apple in a case, and much more frequently one bad peach or plum, has reduced the value of the case of fruit to almost vanishing point. It goes without saying, therefore, that care in handling the fruit during packing and during the process of placing it in the hold is of the greatest importance.

(To be continued.)

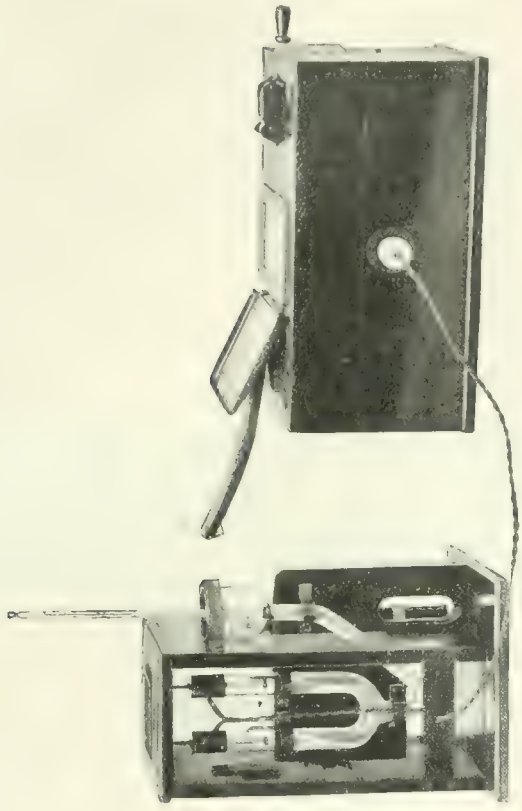


Fig. 2 Dionic Water Tester

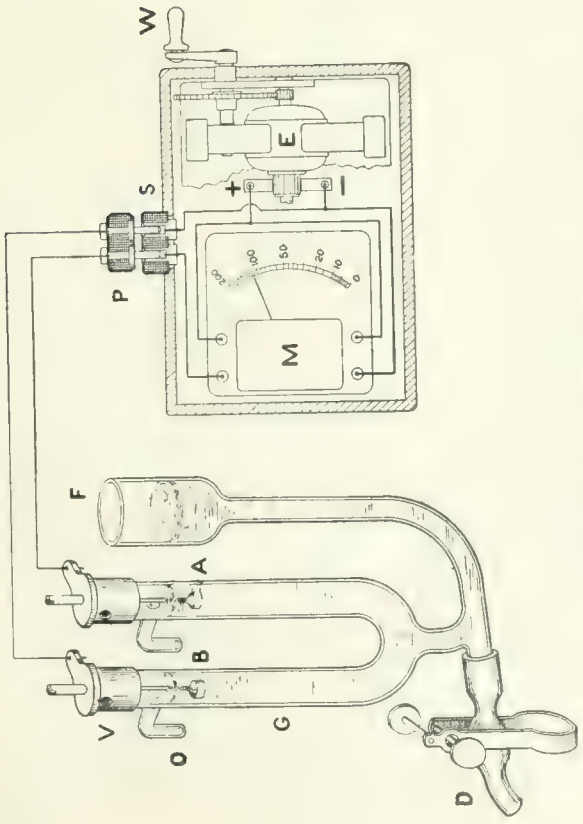


Fig 1 Dionic Water Tester

THE DIONIC WATER TESTER.

THE detection and estimation of impurities dissolved in water has hitherto been carried out by chemical tests of more or less complexity, and water testing suggests at once a skilled chemist and all the paraphernalia of a chemical laboratory. We have recently had the opportunity of reading a very interesting pamphlet by Mr. S. Evershed, of Messrs. Evershed & Vignoles, Ltd., Acton Lane Works, Chiswick, dealing with a new device called the Dionic Water Tester, by which an extremely simple electrical measurement of conductivity is substituted for the chemical reactions hitherto used for the purpose.

The working principle of the apparatus is based upon the fact, established by Kohlrausch, that the conductivity of pure water containing any electrolytic substance in solution is due almost entirely to the dissolved substance, and only to a negligible extent to the water itself. Kohlrausch further established the law that, provided a solution is very dilute, the conductivity is proportional to the percentage amount of the substance dissolved in the water. That is to say, the conductivity is proportional to the number of ions so long as they can travel freely without jostling one another. When, therefore, the composition of the dissolved matter is known, the conductivity of the solution is a measure of the quantity present in the water.

Now, while the Dionic Tester is thus able, by measuring conductivity, to measure with accuracy the percentage amount of any electrolytic substance dissolved in water, it does not, of course, discriminate between one kind of substance and another; analysis alone can do that. But in most instances in which water testing is carried out for engineering and kindred purposes, the substance present in the water is well known, having been ascertained once for all by analysis, or being inherent in the source of supply. Such tests are not made for purposes of analysis, but to find out how much of a known substance is present in the water; and in all these cases the Dionic Tester gives the required answer with a rapidity and simplicity unapproached by any chemical test.

The complete apparatus is shown in Fig. 1, where G is a bent glass tube to contain the water under test, and A and B are the electrodes for passing the electric current through the water. The electrodes are connected by wires to a direct-reading conductivity meter M, and a continuous-current hand-driven dynamo E; so that by turning the handle W of the dynamo, a current traverses the meter and the water in the conductivity tube G. The pointer of the meter is deflected, and comes to rest at some point upon the scale which directly indicates the conductivity of the water in the tube. The test is completed as soon as the pointer has come to rest, that is to say, in two or three seconds.

The tube G is made long enough, and the electrodes are given sufficient surface, to make the electric resistance in the parts of the current-path immediately surrounding the electrodes negligibly small compared with that of the length of water in the tube. Hence, gas bubbles may accumulate on the electrodes without making any observable difference in the measured conductivity. Moreover, gas bubbles liberated from the electrodes rise upwards and escape freely at the

upper ends of the tube; they can never diminish the conductivity by travelling downwards into the path of the electric current. The electrodes are short hollow cylinders of platinum, so that they present a large surface, from every part of which gas bubbles are free to escape upwards.

It is not necessary to describe the little dynamo. It is a standard appliance for testing purposes, being identical with the machine used for testing electrical insulation.

Referring again to Fig. 1, it will be seen that the conductivity tube is so constructed that by pouring water into the funnel F, and allowing it to overflow through the outlet pipes O O, every part of the tube is thoroughly washed out, and any products of electrolysis which may have accumulated upon the electrodes are at the same time swept away by the water. The air vents V V ensure a steady flow from each outlet without any syphoning action. A drain pipe D of pure rubber is provided at the bottom of the tube for the purpose of drawing off the contents at the conclusion of a test. Normally, the drain is closed by a pinch-cock. Water may be left standing in the tube for days at a time without the slightest trace of contamination from the rubber finding its way into the conductivity tube. The only other materials in contact with the contents of the tube are glass and platinum.

Fig. 2 shows the tube mounted on a strong teak stand designed to afford as much protection as is consistent with accessibility, and the conductivity meter and dynamo fixed inside a box and once for all connected up to each other and to the terminals of the socket S, which is fixed on the outside of the box. The two-pin plug P is permanently connected up to the electrodes A and B by means of a short length of well-insulated twin-flexible cable: hence all the user has to do in order to connect the tube to the meter is to push the plug into the socket.

We have had the opportunity of witnessing a most complete demonstration of the merits of the apparatus, and the results are such that they will, we feel sure, greatly interest any of our readers to whom the purposes of the invention appeal. The first experiment was commenced by testing the conductivity of distilled water which showed 3 on the scale of the instrument, and the amount used was about one-eighth of a pint. The water was drawn off again and then stirred with the finger, in which operation a certain amount of saline matter was taken up from the perspiration from the finger. The water was then returned, when the indicator stood at 6·5, showing the extreme sensitiveness of the test. Again, the experiment was repeated with fresh distilled water to which one drop of sea water was added, the addition being in the ratio of 1 to 1300, when the indicator showed 41, a most striking result when one remembers the small amount of salt in the one drop of sea water. Of course, for testing the amount of salt in boilers or condensers the liquid tested is suitably diluted with distilled water to come within the range of the instrument.

As a means for testing the purity of drinking water on board ship, the instrument is invaluable, and, we think, should have a wide scope for this purpose alone.

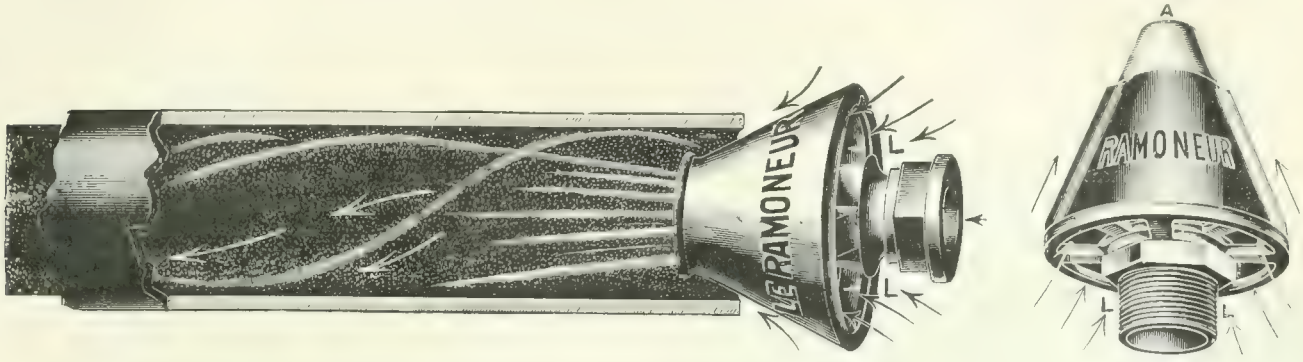
We understand that the apparatus is the invention of Messrs. Digby & Biggs, of Westminster.

LIVERPOOL MARINE ENGINEERS AND NAVAL ARCHITECTS.

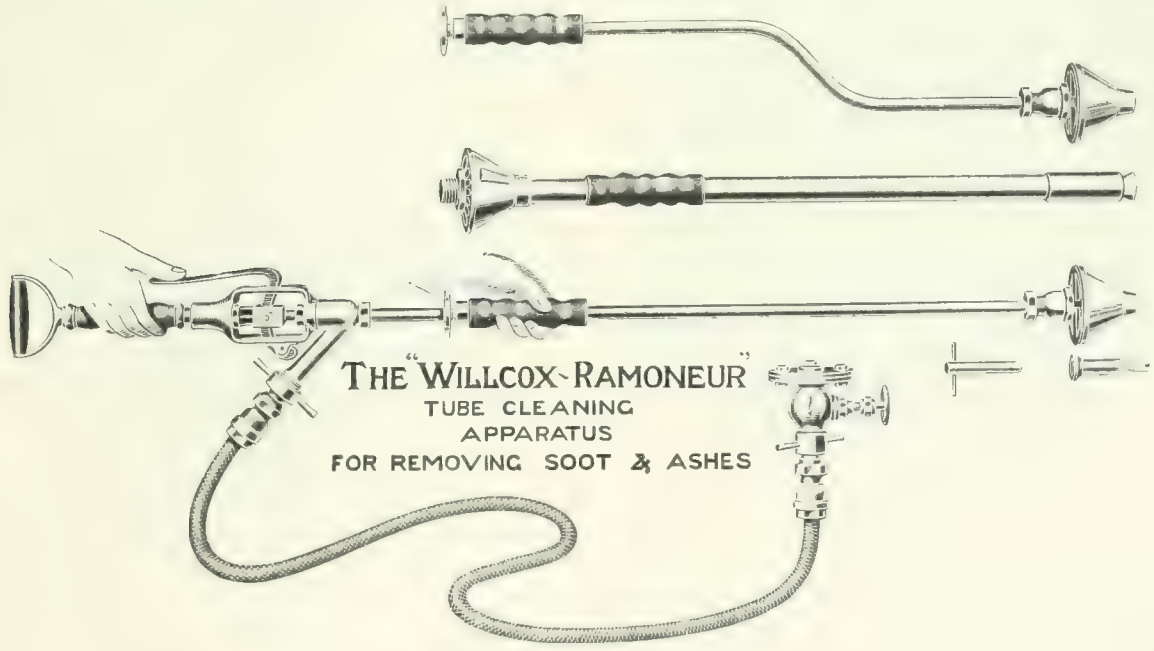
THE annual dinner of the Liverpool Marine Engineers and Naval Architects was held on December 10th, presided over by Mr. J. A. F. Aspinall, and the guests included leaders of the shipping lines of Liverpool. Professor Watkinson, in proposing "The Steamship Trade of Liverpool," referred to the advances made in a century of progress, both in railway and steamship lines, which, combined, had been the means of bringing increased comfort and happiness to the people. The enterprise characteristic of the Cunard Co. and of the White Star Co. was commented upon, the largest and the fastest steamers being products of this. The tonnage of vessels registered in Liverpool in 1800 was 1,500,000; last year it was 17,000,000. There had been several developments in connection with propelling machinery during recent years, and others were coming forward. He gladly intimated that the Guild of Help had been doing good work and was prospering in connection with their Society. Mr. H. A. Sanderson, in responding, said the shipping trade was as the life blood of the nation, and every one on whom its interests depended should therefore do his best to maintain and develop it. The efforts made and being made to uphold the position of Britain as the maritime nation showed that those responsible for the advancement of the leading lines were alive to the necessities and requirements of the day. Shipowners were instrumental to a great extent in adding to the prosperity of the people and contributing to the peace of the world by providing means of intercommunication among nations, and in doing so they were indebted to the engineers for the hearty support given by them in their own special lines of duty. The changes and improvements projected in engineering practice were sometimes embarrassing to the shipowner, as up-to-date steamers soon became obsolete when a more suitable type of machinery was produced; no doubt this was accentuated by the keen competition. The rates were now so low and the luxuries provided for the fastidious traveller of to-day were so great that shame might bring a blush to the would-be passenger as he booked his passage and paid so small a fare. "The Liverpool Marine Engineers and Naval Architects" toast was proposed by Mr. A. A. Booth, who expressed pleasure on being present at the gathering and having so congenial a duty. From a business point of view he discussed the changes and developments which had taken place in propelling machinery, from the simple engine to that of the present day. Each change, which gave more economy, was adopted on commercial considerations arising out of the probable gain against additional space occupied and weight, with less carrying capacity. The question of speed was an important and determining factor in some cases, but other considerations swayed in others. The most profitable unit of transport varied according to the particular trade. The internal combustion engine was spoken of as the engine of the near future; it might be so for certain types of ship, and probably only for them. The profitable transport unit was growing larger as time passed on, and the ship of 1000 ft. length and 70,000 tons displacement was nearer. The limitations of ports, harbours and docks hampered the shipowner until the authorities bestirred themselves to provide for the larger vessels, and this they had done and were doing for meeting future needs. Mr. E. C. Given responded and acknowledged that the complex questions which the marine engineer and naval architect faced were many and great, while the results of their work were very important. Added to the main and auxiliary machinery for propulsion, the enormous meat-carriage by refrigerating came under the care of the marine engineer, and it was his pride to do his utmost to meet the demands made upon him, demands which were often like to pressing a quart into a pint measure. Mr. Willett Bruce proposed "The Guests," and said it was gratifying to see so many distinguished guests at their table. Professor W. S. Abell, in responding, referred to the service rendered to the science of naval architecture by the Elder family, and to the experimental tank to be established at the Liverpool University. "The Chairman," proposed by Mr. A. S. Collard, was responded to by Mr. Aspinall, who advocated the claims of the university upon shipowners and all interested in the progress of marine engineering and naval architecture.

THE WILLCOX-RAMONEUR SOOT-REMOVING APPARATUS FOR MULTITUBULAR BOILERS.

THE experiments which have been made by engineers in charge of land boilers have gone to prove the value of clean heating surfaces, both in regard to greater ease in raising steam and higher efficiency of the steam producer, with consequent economy of fuel. Taking the economy of fuel into consideration it has been found as a result of trials made with a view to determine the saving of fuel due to scraping and cleaning the heating surfaces periodically, that the labour expended is more than compensated for by the increased efficiency of the boiler, while the saving in fuel is a considerable financial credit to the working expenses. The formation of soot on the heating surface is detrimental to efficiency and economy, and its removal is a matter which has exercised the minds of those in charge of boilers and of the inventive faculties of those who would fain introduce an apparatus to do by mechanical means, while the boilers are under steam and at work, what has frequently to be done with the boilers out of office, as and when they can be dispensed with for the purpose. The cleaning of tubes, whether of the water tube or the smoke tube type, offers a readier solution than the cleaning of back ends, and for this several means have been proposed. The ordinary method of brushing and scraping the tubes at ports of call where time admits, involves longer intervals than are desirable to those who wish to keep the tubes clean. Recognising this, not a few schemes have been tried, and among them is found an excellent one, based upon an extended experience, namely, the Willcox-Ramoneur Hot-Air Impelled Tube-Cleaning Apparatus. The use of direct steam for cleaning tubes is objectionable for two reasons. It causes a loss of fresh water, apart from the loss of steam, and it is bad to have damp surfaces, the tendency being to cake the soot and add to the difficulty of removing it, corrosion is also induced. The apparatus illustrated uses steam, but only as an impeller; the formation of the nozzle is such that a large body of warm air is induced from the smoke box in the proportion of 1 steam to 10 air, to be ejected with the velocity of the steam



Air is forced through under pressure by a jet of dry steam.



Works with hot air under pressure.

through the tube in the ordinary marine, or around the tubes in the case of the water tube boiler, thus removing all soot from the tube heating surface. The operation can be accomplished speedily, and without interfering with the fires; trials have shown that 80 tubes can be blown through and cleaned in five minutes. It will be seen from the illustrations that the apparatus admits of easy manipulation, the steam is carried by means of flexible tubing to the apparatus on which is an adjustable valve to operate the flow by hand, the nozzles are made to suit the different classes of boilers at the delivery end to get the best effect. The "Ramoneur" specially appeals to marine engineers, as by making use of such the tubes of the boiler can be kept perfectly clean throughout the voyage, causing a great saving in fuel and an improved efficiency of the boiler. We are informed that owing to its success the British Admiralty have adopted the apparatus, also several leading shipbuilders and engineers in this country and Colonial and Foreign Governments. The principal of the working of the "Ramoneur" is that

The "Ramoneur," in operation on a Marine boiler.

although steam is taken from the boiler, yet it only acts as an impelling force. This steam is mixed with ten times its volume of hot air from the surrounding flues, and thoroughly dried, and by the special construction of the conehead this mass of hot air is passed through the tubes in a whirling motion, clearing away all soot and other loose deposits. An important advantage which will immediately commend itself to engineers is, that the cleaning is done whilst the boiler is under steam. From the actual results obtained by all classes of users, this apparatus no doubt fills a long-felt want, and it has proved itself a great saver of time, labour and fuel. Messrs. Willcox will send an apparatus to any user of multitubular boilers for trial, so that the users may be thoroughly satisfied with the results, and should note that there are no sensitive parts to get out of order.

H.M. BATTLESHIP-CRUISER "LION."—Copies of the original drawing of this fine war vessel may be obtained from the Publisher on plate paper, signed by the artist 2/- post-free, framed 4/6.

SCHOBERT'S PAINTS.

A NEW combined anti-fouling and anti-corrosive composition is now being put upon the market by Messrs. Schoberts, 150, Leadenhall Street, London, E.C. It is claimed that only one coat of the composition is necessary, and that a ship after having been painted can go at once into the water. In tests as to the existence of any galvanic action being set up on contact with sea water, it has been stated by Professor V. B. Lewes of the Royal Naval College, Greenwich, that Schoberts claim that their composition cannot set up any corrosion by any galvanic action; the vehicle in which the poison is painted on a ship plays as important a part as the poison itself. We understand that this absence of any galvanic action when the paint of the ship comes into contact with sea water is owing to the fact that copper, mercury or antimony, or compounds thereof, are entirely absent from the composition. Experience has shown that no corrosion takes place, and that the fouling of the ships' plates after long immersion is minimised to the least possible minimum. We have had the opportunity of reading some of the reports made by British shipowners, and it is quite clear that their testimony goes to show that no fouling at all takes place, in fact on some voyages in which a ship has visited some of the worst fouling harbours in the world there was no grass on the body of the ship, and only some shell gravel on the bottom, which latter on being scraped has shown quite a clean surface of paint, and in addition there were no signs of corrosion and pitting, which were very prominent when the ship was originally painted with compositions other than Schobert's. This firm also sell a de-oxidizing paint for painting the hold and deck fittings, as a protecting covering for iron or steel exposed to severe oxidizing influences. This paint spreads very well under the brush, and one ton of such paint is about two hundred gallons. In order to show the comparative merits of this paint with another well-known paint, a test was recently carried out under which the inside of a ship was painted by Schobert's composition and by a composition by another maker, each maker painting half of the ship, the result showing that 9 cwts. of Schobert's paint was used, of which one coat was found amply sufficient, while over twice as much was used of the other paint, two coats being found necessary. Some three years ago a gasometer was painted with this paint, and this year was examined, when it was found that the iron had been perfectly preserved, both inside and out. We understand that a new London factory is being built by Schobert's to enable them to cope with the ever increasing demand for their productions. It is claimed by the manufacturers that all other ship paints contain either copper, mercury or antimony, which when in contact with sea water convert the ship into a huge galvanic battery, with the result that heavy corrosion sets in. These products appear to have been carefully tested and to have come through their examinations with satisfaction to the exploiters, and we trust also to the inventor himself.

THE UNITED STATES METALLIC PACKING CO., LTD., have received from the authorities at Buenos Aires, information that a gold medal has been awarded to them for their exhibit of packing.

CLYDE SHIPBUILDING FIRM'S CENTENARY.

MESSRS. WILLIAM SIMONS & CO., LTD., Renfrew, this year celebrate their centenary as a shipbuilding firm, and on December 10th they entertained their staff and a number of business friends at dinner in St. Enoch's Hotel, Glasgow. Mr. William Brown, M. Inst. C.E., Chairman and Managing Director of the Company, and Mr. Walter Brown his co-managing director, were presented with illuminated addresses, expressing the respect in which they are held by all their employees, and congratulating the directors on the centenary of the Company. Although having a record of continuous work as shipbuilders for the hundred years, the *locale* of operations has not always been the present works at Renfrew. Indeed, for a time at the beginning, the *venue* was not on the Clyde at all, but on the St. Lawrence, near Montreal, Canada. The firm, however, have occupied their present works at Renfrew for over fifty years, during which they have specialized in the construction of dredging craft of all kinds, producing dredgers and barges of a variety of types for many of the leading ports of the world, and introducing into their design and construction ingenious features of novelty to meet the particular conditions and the nature of the work to be accomplished.

Mr. Wm. Brown, M.I.C.E.

Mr Walter Brown, M.I.N.A

While the reputation of the firm as dredger builders is world-wide, it is not so well-known, and may indeed be quite new to many to learn, that behind the fifty years of specialized dredger-building, there lies a most interesting story of ship-building, at Greenock, Montreal, Whiteinch and Renfrew, in which, variety, new departures and notable success are features. The record of work accomplished since the establishment of the business by Mr. Wm. Simons, senior, at Greenock, in 1810, embraces sailing ships, racing yachts, fighting frigates and gun-boats for the British Navy, passenger steamers for ocean services, high-speed river and channel paddle steamers, and more particularly, for many years, marine dredging plant of all kinds. Of dredgers alone, since the works were removed to Renfrew the firm have constructed upwards of 200 vessels, ranging in hopper capacity from 150 to 3000 tons, and having a dredging capacity of from 100 to 12,000 tons per hour.

The firm have seldom been busier than at the present time, their building stocks and engineering shops being occupied with dredgers and dredging plant of varying type for a wide area of destination. Their woodworking departments—re-constructed and re-equipped after the serious fire of several months ago—are being brought into complete working order. To keep in the van of shipbuilding progress, the whole works are now equipped with electricity for power as well as lighting. The supply of electricity is taken from the generating station of the Clyde Valley Supply Co., at Yoker, on the opposite side of the Clyde. The yard central power station includes a high-chamber, containing the large static transformer for the reduction of the high-

pressure current of the Supply Co. It also contains three sets of motor generators ranging from 75 to 250 kilowatts. There are two switch-boards, one for distributing alternating, and the other continuous, current motors for both systems installed in connection with the main drives of the shipyard and of the engineering and other shops. In the building yard all the lifts, including the various winches, are electrically driven. The power station also contains two compound Ingersoll-Rand air compressors of ample capacity for supplying all the pneumatic tools in the establishment.

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

The Royal Mail and its Chairman.

THE feature of the year 1910 in shipping matters has surely been the activity of the Royal Mail Steamship Company and of its chairman, Sir Owen Philipps. That gentleman assumed the chairmanship of the Company but seven years ago, when it confined its activities to the West Indian, Brazilian and River Plate trades, having a fleet of about 90,000 tons of shipping contained in single-screw ships of which the largest did not exceed, say, 5000 tons. Now in its own special business it has five ten-thousand ton vessels of the most improved twin-screw type, with a sixth on the stocks at Belfast. By the end of the year 1909 it had eaten up the Forwood line to Morocco, had a dash at the Australian trade with the Orient Company, and had a slice of the Shire Line to take it into the Far Eastern trade. But in 1910 it really began moving! Early in the year Sir Owen Philipps, in conjunction with Lord Pirrie, took over all the diverse interests of the late Sir Alfred Jones, Sir Owen becoming chairman of a new limited company, Messrs. Elder, Dempster & Co., Ltd., to carry all those various properties. This gave him the direction of a new fleet of no less than 344,000 tons of steamships, and also gave him the entry into the West African trade, the banana trade to Jamaica, and made him a mill-owner, banker, hotel-keeper, underwriter and merchant as well as a shipowner. Then on behalf of the Royal Mail itself he bought the whole of the share capital of the Pacific Steam Navigation Company with a fleet of 177,000 tons—paying a million and a third in a single cheque. It might have been supposed that the digestion of these two huge meals would have taken some little time. But already there has taken place a fresh absorption, this time by the Elder, Dempster Company. It was announced early in December that that firm had obtained a controlling interest in the Glen Line—Messrs. McGregor, Gow & Co. It was only in August, 1910, that this Company was registered with a capital of a quarter of a million sterling to take over the fleet, There was no public issue. At that time there seems to have been a fleet of nine vessels under the company's management. They were :—

		Year built.	Builders	Gross tonnage.
1.	Glenesk	1891	R. Stephenson, Newcastle	3524
2.	Glenfarg	1894	London and Glasgow Co., Glasgow	3647
3.	Glenlochy	1896	London and Glasgow Co., Glasgow	4654
4.	Glenlogan	1896	Workman, Clark & Co., Belfast	6723
5.	Glen Turret ..	1896	London and Glasgow Co., Glasgow	4096
6.	Glenroy	1896	London and Glasgow Co., Glasgow	4901
7.	Glenavon.....	1901	Swan, Hunter & Wigham Richardson, Newcastle	4262
8.	Glencarn	1905	Swan, Hunter & Wigham Richardson, Newcastle	4461
9.	Glenstrae.....	1905	Hawthorne, Leslie & Co., Newcastle	4718

Of these ships the *Glencarn* and *Glenavon* were recently transferred to the Ellerman Line. They had previously been purchased from the Hall Line of Liverpool. Thus the actual fleet transferred to the new management consists of seven vessels comprising a total of 31,978 tons. The *Glenlogan* was formerly the *Denton Grange* of the Houlder Line.

The Union-Castle Line.

It is an ill wind that blows nobody any good. An outbreak of cholera at Madeira has made it advisable, in the opinion of Messrs. Donald Currie & Co., for their mail steamers to discontinue their usual call at Madeira, and so by arrangement with the British and South African Governments both the outward and homeward mail steamers will visit one or other of the two ports, Las Palmas or Teneriffe instead of calling, as is their custom, at Funchal. The run to the Canary Islands will be made in about four days from Southampton, and no doubt the Fortunate Islands will be rendered even more attractive this winter by the additional facilities thus afforded to the tourist and the business man.

The "Mauretania."

The Cunard Company undertook a big thing when they announced that the *Mauretania* should be their "Christmas ship" from New York this winter without any change being made in their published westward itinerary. For this meant that, sailing as she did from Liverpool in her appointed turn on Saturday, the 10th December, she would have to leave New York on her eastward run just seven days later. Having made up their minds that the thing could be done the big ship was announced to leave her pier at New York at 6 p.m. on the 17th December, and on that understanding passengers were booked until the ship could book no more. Knowing that she would be driven for all she was worth on the outward run some passengers actually arranged to make the round trip in her to share in a unique experience. Vast preparations had to be made to get the ship turned round at New York in the schedule time, which—on the hypothesis that she would do her 26 knots all the way out and land her passengers on the evening of Thursday, the 15th December—meant a stay of but forty-eight hours in the Hudson. For the outward run extra stokers were shipped in order that a full load of steam might be carried all the way. Sailing in due course, she was reported as leaving Queenstown at 9.55 a.m. on the morning of Sunday, the 11th December. December often is favoured with calm weather on the Atlantic. But it was not so this year. Whilst the *Mauretania* was forcing her bows into the Atlantic head sea the coasts of these islands suffered from a gale which lasted the best part of a week, and did damage of an unprecedented character at Dover, Shoreham and other British seaside places, disorganizing the Ostend and French services, and breaking up the wreck of the big sailing ship *Preussen*, which had withstood some weeks of buffeting under the Kentish cliffs. On the morning after her departure from Queenstown the *Mauretania* in 51 N. Long. 21 W., passed through the centre of a very deep cyclonic system. At 7 a.m. on that day the wind being then light—after a strong S.S.W. gale three hours earlier—the barometer fell to 28.04 inches. A violent westerly and north-westerly gale followed, and was endured during nearly the whole voyage, the wind being said to have a velocity of sixty miles an hour when she was off the American coast. Nevertheless the Cunarder made a remarkable crossing. Her daily runs were :—

	Distance steamed.	Speed.
To noon on Monday, the 12th ..	587 ..	23.37 knots.
,, ,, Tuesday, the 13th ..	516 ..	20.72 ,,
,, ,, Wednesday, the 14th	639 ..	25.56 ,,
,, ,, Thursday, the 15th .	635 ..	25.50 ,,
,, 1 a.m. Friday, 16th	340 ..	24.84 ,,

Her total distance steamed was 2780 miles, the mean speed of the run being 23.90 knots, and her time four days, 20 hours and seven minutes. A wonderful performance under the conditions, but at the same time something considerably worse than those interested had a right to anticipate! She arrived in a hard frost and brilliant moonshine. Thus exceptional treatment could be meted out to her. She at once made for her dock, the heavy westward mail being shot into the postal tenders as she moved slowly up the harbour. At 4.30 a.m. she docked and ten minutes later her passengers began to land. She was moored in such a way that coaling could be effected from both sides. At 6 a.m. the heavy task of putting the needful 6500 tons of coal into her bunkers to carry her back to Liverpool was commenced, whilst the westward

cargo amounting to some 800 tons was still being got out of her holds. An immense quantity of "hotel linen"—table cloths, serviettes and bed linen—was sent ashore immediately on her arrival and returned by the contractors in ample time for her departure. In nine hours the first four thousand tons of coal was shipped and it then became apparent that the big task was well in hand. Indeed it was completed by 11 a.m., just an hour after the last of the stores were taken on board. Then came the mail amounting to 3718 sacks, and the passengers numbering in all some 1720, of whom 400 were in the saloon. At the appointed time she cast off from her dock, and passed away to the Atlantic, having accomplished the turn round well within the 37½ hours to which the fury of the Atlantic had reduced her limit. This was a triumph of organization of which the Company may well be proud. It was easy enough, for example, to deal in a couple of days, as often was done, with the liners of an earlier date such as the Inman liner *City of Berlin*, which burnt in the whole crossing not more coal than the *Mauretania* consumes in a single day. The Cunard achievement has been no doubt a costly business, but it has been a grand advertisement, and it must be remembered that when ships lie in dock interest and depreciation are still mounting up. It is assuredly better—so long as due time for overhaul is afforded—to keep them working as much as possible and so earning money to meet the vast expenditure which characterizes everything connected with these monsters.

At 10.22 p.m. on the 22nd December the *Mauretania* completed her task by arriving at Fishguard one hour and thirty-eight minutes inside the time limited to her by Captain Turner, her commander, on leaving New York.

Eastward her daily runs were—

To noon on Sunday the 18th December	..	387 knots.
.. Monday the 19th December	..	582 ..
.. Tuesday the 20th December	..	572 ..
.. Wednesday the 21st December	..	578 ..
.. Thursday the 22nd December	..	580 ..
To 10.22 p.m. Thursday 22nd December	..	108 ..

Total distance run, 2,807 miles; mean speed 25.07 knots. Passage 4 days 15 hours 57 minutes.

The New Cunarder.

It has now been announced that the contract for the 50,000 ton Cunarder has been placed with Messrs. John Brown & Co., of Clydebank, who have constructed the *Lusitania* and so many other famous ships for the Cunard Company. It is believed, however, that another contract for a similar ship will not be long delayed, and it is practically a foregone conclusion that when it comes it will be placed with Messrs. Swan, Hunter and Wigham Richardson, who have been equally successful with the Clydebank firm in supplying the requirements of the premier Atlantic Company.

The Shipping Rings Commission

does not seem to have satisfied the various colonial governments interested in mail carriage. The Straits Settlements and the Malayan Government are legislating in regard to this matter, whilst the United Government of South Africa are introducing a bill for the consolidation of the postal laws of the various federated States. This bill will contain a clause prohibiting the conclusion of a mail contract with any shipping combination whose operations are, in the opinion of the Governor-General in Council "detrimental to the interests of South African trade," or "which maintains a system of rebates compelling exclusive shipment by vessels of the combination." The South African Government is quite within its rights in passing such an Act as is here outlined. But if it does it will have an expensive lesson in political economy. For it will find that if it prevents its contractors from obtaining a due amount of money from shippers for the maintenance of its mail service it will itself in the end have to find proportionately more money for its postal contract, or will have to suffer by getting an inferior service to that which it now obtains.

The Regulations for the Prevention of Collisions at Sea.

Certain additional regulations are now under official consideration. They are intended to provide towing signals, a universal distress signal, a signal for motor boats—which at present (owing to the absence of funnels) may easily be confused with sailing vessels; and for ships carrying explosives.

THE INTERNAL COMBUSTION ENGINE.

PART II.

By MR. WILLIAM P. DURTNALL (Member).

Continued from page 158.

As a means of all these readings the indicator diagram shown at Fig. 13 was constructed. The vertical line is graduated to give the pounds per square inch, and from the diagram it can be seen that the compression was carried up to 75 lbs. per square inch, the ignition taking place considerably before the end of this compression stroke, and the pressure rising

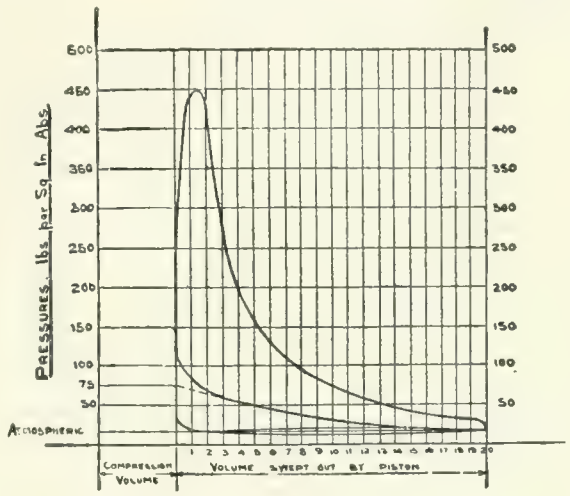


Fig. 13.

very rapidly to about 450 lbs. per square inch when just over the top centre, as it should be. The enormity of this pressure can be better appreciated, perhaps, when given as a total weight on the piston, the bore of the cylinder was 4 in. and the area equalled 12·56 square inches, and therefore the total pressure on each piston is roughly 2 tons. The diagram also shows the fall of pressure during the working stroke, and the slight rise and fall above the atmospheric pressure during the exhaust and suction strokes. At the beginning of the suction stroke, for instance, the piston is being pulled along at an ever-increasing rate, whilst the crank travels through approximately 90 degrees. Then until the end of the stroke the piston tends to keep on moving, and has to be retarded and brought to rest by the crankshaft; in other words, the inertia of the piston and parts moving with it is retarding the crank during the first half of each stroke, and urging it on during the latter half. The pressure in the cylinder and the force necessary to accelerate the piston have both been taken into account in the torque diagram for the single-cylinder engine. The turning effort in Fig. 12 is shown in inch-pounds. For example, at point A, 400 inch-pounds represents a pressure of 200 lbs. on the crank pin, tangential to the crank arm, and acting at a two-inch radius. The thick horizontal line represents the average turning effort during the four strokes, which constitute the cycle (it was a four-cycle engine); it also shows the effort of the inertia of the piston in giving negative and positive turning efforts at the beginning and end of the strokes. At the end of the compression stroke instead of getting a large negative turning effort, on account of the increased pressure in the cylinder, it will be seen that the torque has only a small negative value. This shows that the inertia of the piston coming to rest at the top of the stroke is nearly sufficient to compress the charge, also, when the crank is on the dead centres, there is no turning effort. It is from this diagram with its large variations that we must start and endeavour to obtain that which is absolutely essential, *i.e.*, a constant torque with the internal combustion

*Read before the Institute of Marine Engineers on Monday, the 28th November, 1910.

For Part I. see October issue of *The Marine Engineer and Naval Architect*.

engine, so as to avoid those things that have been previously dealt with as regards vibration, etc. The dotted line in the four-cylinder engine figure is found by superimposing four of these diagrams, corresponding to four cylinders with cranks at 180 degrees. It is not fair to compare the diagrams for four and six cylinders for the reason that the cylinders being all of the same size, the six-cylinder engine will be giving one-and-half times the power of the four-cylinder engine,

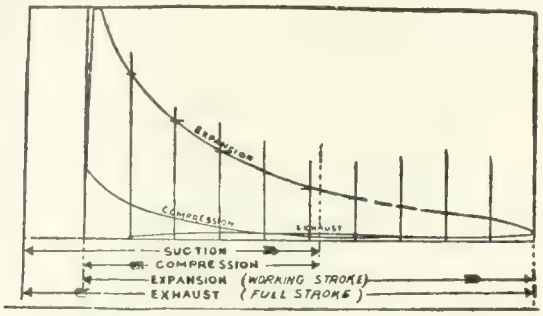


Fig. 14.

therefore each vertical height of the dotted line has been increased one-and-half times to the full line, corresponding to the larger pistons to equalize the powers of the two engines. The interesting point to be noticed is that with the six-cylinder engine there is always a positive effort of at least 700 inch-pounds, on the crank-shaft, and that at no point of the cycle does it approach zero. With four cylinders and with cranks at 180 degrees, there must be of necessity four points in the cycle of operations (when the cranks are on dead-centres) at which there is no turning effort.

that can be written about them, and the total inch-pounds is given for convenience. The foregoing is an illustration of what has to be studied and taken into consideration by those engineers who may be considering the application of the internal-combustion engine for marine propulsion, of large powers, and in the writer's opinion, these will have to run at high revolution speed in order to get the power into the space, also electrical power transmission will have to be used, in order to get the best commercial results for the reasons already explained. The lack of efficiency has been previously noted and one way of correcting this will be to design the engines on other lines, such as, for example—assuming that the compression chamber of engines is at present, say, equal to 25 per cent. of the space or sweep of the piston and clearance, and assume that it is equal bore and stroke ratio, that is to say, 6 in. by 6 in., design the new engines with a bore of 6 in. and 12 in. stroke, let the compression chamber remain the same, and design the induction valve gear so that the incoming gas will be cut off at half stroke, then when the piston returns and compresses this charge, it will have the same maximum compression as the first mentioned engine. We will assume that the ignition takes place in the usual form as explained above; the pressure will at half the out stroke be the same as that of the former engine; now as both engines have received the same amount of gas, they have thus far delivered the same amount of work. The first engine exhausts at this point, but the second has still a charge of perhaps 60 lbs. per square inch, multiplied by four times the compression space. Owing to this fact the pressure will fall very slowly during the remaining part of stroke of the new engine, which is 12 in. instead of 6 in., as in the first engine, and there being no compression pressure to subtract from it, for the simple reason that the compression did not begin before the piston reached half through the compression stroke, as explained. Hence the last part of this stroke is very efficient and the work got for nothing, so to speak, as

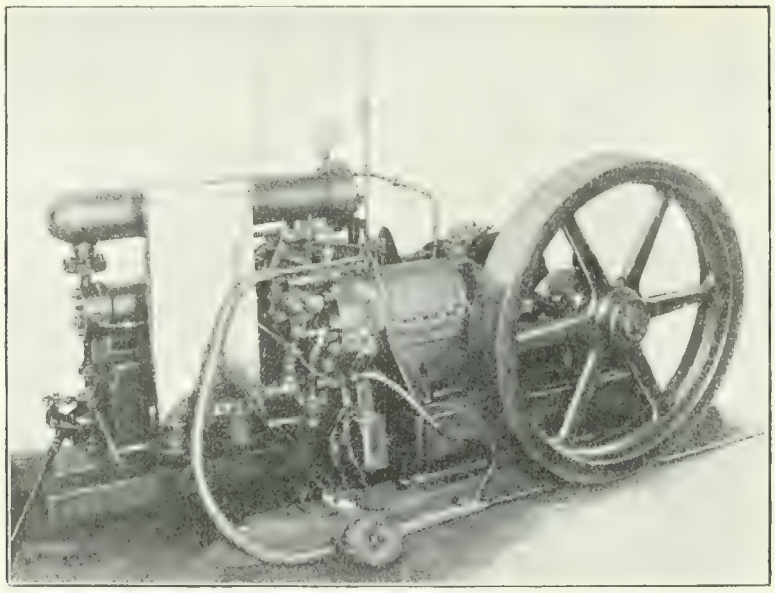


Fig. 15.

The four-cylinder diagram shows also four other points, at which the torque has only a very small positive value, namely, less than 200 inch-pounds, which is accounted for by the retarding force of the pistons when being accelerated, after the effort of the explosion has passed. Had this diagram been constructed for any other pistons than the extremely light ones such as are used on petrol engines of the Napier type, it is extremely probable that at this point the torque would have had a considerable negative valve. The next rise in the torque is due to the forward pressure of the pistons when nearing the end of the stroke. A comparison of the two diagrams will be far more convincing than anything

compared with some of the existing types of engines. This is well worth the attention of designers of internal-combustion engines, as it is certain that we have no losses to allow for due to compression, for this added power, nor the loss due to large leakage and heat losses under the high pressure and temperature at the beginning of the working stroke. Taking these facts into account the design of this engine would do at least 25 per cent. more efficiency for a given amount of fuel than the engines that have equal stroke and bore and the valves arranged in the ordinary manner. The output of this engine would be only perhaps two-thirds of the work obtained by the other method, but the efficiency and power may be

further increased by raising the compression, for the higher point of compression is reached so much later in the stroke, that the point of self-ignition will be nearer the dead centre.

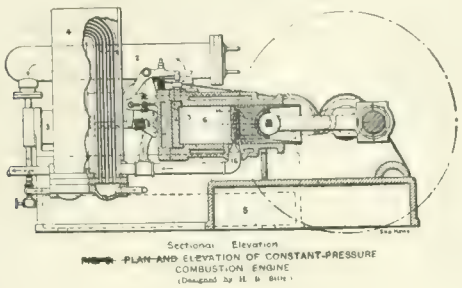


Fig. 16.

The average temperature is lower and better suited for marine work, owing to the consequent reduction in the amount of circulating water required. The dimensions given are only for convenient illustration, they will, however, serve to point out a method that is being investigated, and so far as the

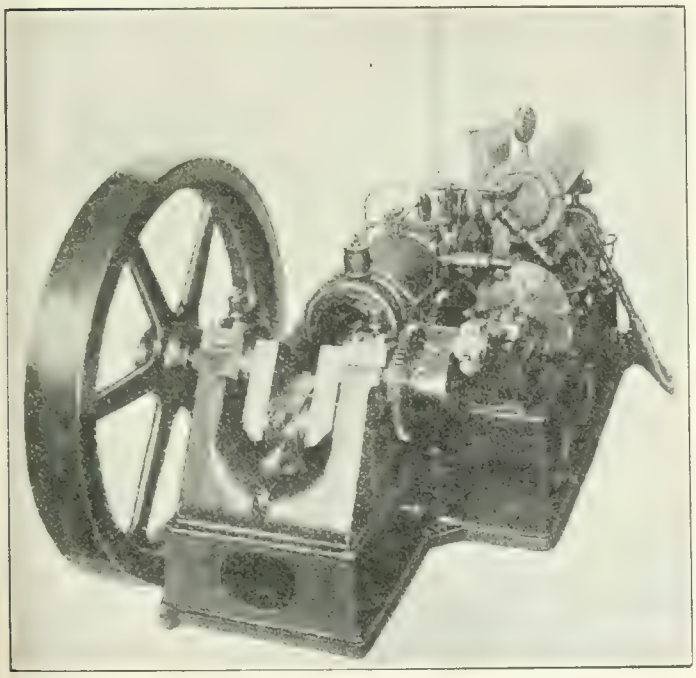
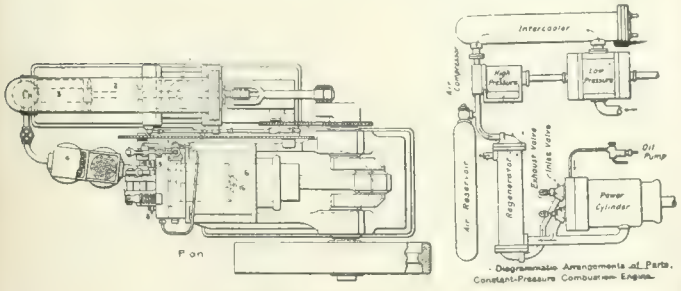


Fig. 17.

matter has gone shows that the idea is not so far wrong and that views expressed that the internal-combustion engine will in the early future be greatly improved both from thermal and mechanical points of view. Fig. 14 gives some idea of the diagram that may be found on such an engine.



Figs. 18 and 19.

In the early part of this paper reference was made to the type of engine most suitable for large powers, such as will be required for the propulsion of large war and other ships. An interesting example of one is from an inventor in America who has been working on the subject of the Brayton cycle and has constructed an engine shown in Fig. 15. The side view gives the separate compression pumps and inter-cooler as seen.

Fig. 16 shows a side section of this interesting engine, which in the writer's opinion has a great future before it. Fig. 17 shows the engine head-on, it will be seen the method adopted for the driving of the pumps from the crank shaft (Fig. 18) is a plan of the engine showing the small inter-cooler and general layout. Fig. 19 shows the cycle and apparatus in diagram; it will be noticed that this engine is fitted with air compression reservoir enabling the engine to be started by means of a valve similar to the method adopted in steam

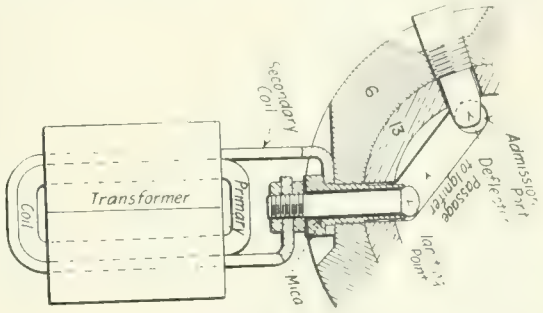
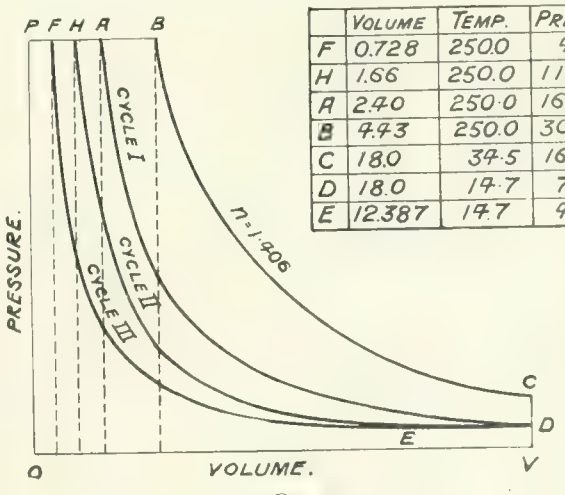


Fig. 20.

engines. Fig. 20 shows the type of low voltage ignition that has been adopted in this engine, which is more than likely to have a future use in engines of large power in this country.



	VOLUME	TEMP.	PRESS:
F	0.728	250.0	493
H	1.66	250.0	1122
A	2.40	250.0	1622
B	4.43	250.0	3000
C	18.0	34.5	1690
D	18.0	14.7	718
E	12.387	14.7	493

Fig. 21.

Fig. 21 shows the constant pressure combustion diagram of cycles for this engine, which it will be observed is very similar to that of the Diesel. The engine operates on the two-stroke cycle and much more will be heard of it in the early future. The valves are similar to those used in superheated steam practice, and the engine has stood some remarkable tests very satisfactorily. In the interests of this Institute, coupled with the great British shipping industry, it is hoped that the preceding notes may be of value and that those who have neither the opportunity nor the time to study this problem of the future of sea transport, will find something that will further their knowledge on the subject. Should this be so the pleasure he has had in going into many details in order to lay these scant notes before the members will be greatly enhanced.

The author wishes to express his acknowledgment of the assistance he has received in the preparation of this paper from the following:—"The Motor," "The Motor Boat," "Engineering News," "Self-Propelled Vehicles," by Mr. J. E. Homans, and Mr. F. S. Edge's paper read before the Royal Automobile Club, The Diesel Engine Co., The M.A.N. Diesel Engines, The Griffin Engine Co. and The Lamplough Engine Co.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(*From our Own Correspondent.*)

Portsmouth Dockyard.

DURING the month a large quantity of material has been received for our new ship, and preparations are being made so that when the keel plates are once laid progress will be fairly rapid. Beyond the fact that the vessel is to be a battleship longer and wider than the *Orion* nothing very much is known, at least outside official circles. It is reported, though nothing is known officially, that the King and Queen will pay us a private visit about January 17th, and that they will remain on board the yacht *Victoria and Albert*. The visit, it is said, is to last several days, and their Majesties will probably inspect the naval establishment. Hopes are entertained that the Queen will lay the first keel plate of the new battleship, which, it is confidently believed, will be named in honour of King George. His Majesty's yacht, the *Victoria and Albert*, is at present undergoing an extensive refit and overhaul, but she will be out of hand by the middle of January, so that should their Majesties pay the anticipated visit the vessel will be ready for them. We had a visit at the beginning of December from Mr. J. Marshall, C.B., the Director of Dockyards, who conferred with the admiral-superintendent and the principal officials of the yard as to the programme of work to be carried out in the coming financial year. The battleship *Neptune* has carried out her acceptance trials in a most satisfactory manner. She is now being prepared for commissioning, and is to be out of hand by January 19th. The vessel was laid down on January 19th, 1909, so that it will be exactly two years from the time of her being begun until she hoists the pennant. The *Neptune*, as anticipated in this column some time back, is to be the flagship of the next Commander-in-chief of the Home Fleet, who is to be Vice-Admiral Sir Francis Bridgeman. Although the First Lord of the Admiralty has stated that there is plenty of docking accommodation in this yard, it is only by working day and night shifts that the periodical docking of vessels can be kept under. This has been going on for some time past, and the difficulty is getting more acute, owing to the increasing number of destroyers and submarines. Shortly after midnight on December 5th a fire broke out in a joiners' shop in the yard, but the dockyard police with the fire apparatus were soon on the spot, and parties of seamen were landed. They succeeded in extinguishing the fire in less than a couple of hours without very much damage being done. An order has been received for the steam collier *Mercedes* to be fitted with the Metcalfe system of coaling at sea.

Devonport Dockyard.

The cruiser *Lion* is making rapid progress and the work of placing in position the armoured plates forming the broadside protection of the vessel is well under way. The work on the upper deck is also proceeding apace and the super-structure is beginning to assume a shapely appearance. The underwater work, consisting of the boring out of the main shaft and rudder bearings, is practically completed, and work in the engine and boiler rooms is well advanced, so that in a short time everything will be ready for the reception of the powerful turbines. The three enormous funnels are nearing completion, as are also the twin rudders, and altogether the vessel looks as if she had been under construction for a much longer period than thirteen months. Preparations are being made for laying down our new battleship on the slip from which the *Lion* was launched nearly five months ago. The ceremony will take place during the second week of January, but we shall not be so fortunate as our friends at Portsmouth, who are expecting the Queen to lay the keel plate of their new battleship. The trials of the cruiser *Indefatigable*, which have been carried out up to the time of writing, have been remarkably successful, and there seems no reason why she should not be ready for the pennant by February 23th as ordered. With regard to refitting work, the cruiser *Highflyer* has been completed and leaves immediately for Chatham to take up duty in the Nore Division of the Home Fleet, and the battleship *New Zealand* has been taken in hand for her annual overhaul. In consequence of a serious breakdown in her steering gear the battleship *Commonwealth* has again been taken in dockyard hands. She is to have a new set of steering fittings and pistons, and it is expected that she will be completed by the end of January. The *Kestrel*, of the Fifth Destroyer Flotilla, having been ordered to undergo a refit at Gibraltar, left for that port at the end of November under convoy of the battleship *Swiftsure*, which had been home to recommission. On arrival at Gibraltar the crew of the *Kestrel* was transferred to the *Mermaid*, which has had a refit there, and the latter vessel is to return here under escort of the *Triumph*, which is coming to England shortly to pay off and recommission. The battleships *Repulse* and *Royal Sovereign*, which have been for some time past in the special service squadron of the Home Fleet at this port, have been ordered to be sent to Portsmouth to be prepared to be laid up at the Motherbank. The *Ramillies* and *Resolution* were at first ordered to be sent, but no doubt their turn will come before very long. Another vessel is about to disappear from this port, the destroyer *Contest*, which was built by Laird Brothers, of Birkenhead, sixteen years ago, having been placed on the sale list. Early in January we shall be losing the captain of the dockyard and King's harbour master of the Hamoaze. The officer who bears this cumbrous title is Captain Tuke, and he is to be relieved by Captain Le Marchant, who since April, 1909, has been in command of the Southern Coastguard District at Southampton.

Chatham Dockyard.

The Admiralty have for some time past been considering the question as to where the new floating dock is to be moored in the river Medway, and it has now been announced that a spot has been selected in Saltpan Reach, which is a few miles below this yard; and that it will be worked from this establishment. The claims of Sheerness were strongly urged by those connected with that town, but the decision come to will doubtless prove the most advantageous from a service point of view. There is every likelihood that when the dock is in working order the number of workmen at this yard will be increased. It is to be hoped that the floating dock is only a temporary measure and that before many years the Admiralty will see their way to construct permanent docks here large enough to take *Dreadnoughts* and super-*Dreadnoughts*, for there is plenty of Government land available at Chatham or in the neighbourhood. The refit of the cruiser *Euryalus* has been completed and she has been commissioned for service in the Devonport Division of the Home Fleet. Her refit has cost almost £80,000, and, needless to say, her efficiency has been considerably increased. We were very glad to get her out of hand, as we are extremely busy with repair work. The *Vulcan*, the depot ship of Section VII. Submarine Flotilla, has arrived from Dundee for a refit, and she will probably be completed by the end of January. The battleship *Magnificent* and *Victorious* arrived during the first week of December for refits. Both vessels are to go to Devonport when completed, the former for service as a turret drill ship and the latter for service in the Home Fleet at the Western port. The cruiser *Dido* has been taken in hand for an extensive refit, as has also the destroyer *Derwent*. On December 29th the *Shannon*, flagship of the Second Cruiser Squadron, is due for a refit and the following day the battleship *Bulwark* is to arrive for a similar purpose. The *Bulwark* is the flagship of Vice-Admiral Sir George Neville, commanding the Third and Fourth Divisions of the Home Fleet. Then early in February the armoured cruiser *Indomitable* is due for her annual refit. So altogether we are well provided with work for some time to come. The torpedo gunboat *Skipjack* has completed her refit and has left to resume fishery duties in the North Sea. The Dockyard Engineering Association, referred to last month, which was only started last year, is making remarkable progress. At the opening lecture of the session it was stated that there were 482 members and there was every probability that before long this number would reach 500. Engineer-Rear-Admiral C. Rudd, the engineer-manager, will retire early in January on reaching the age of fifty-five, but no announcement has yet been made as to who his successor is to be. Two court martials have been held at this port recently in connection with the stranding of the destroyer *Porcupine* off Clacton on October 18th, and the grounding of the destroyer *Fervent* on the Maplin Sands on November 26th. The commanding officers were reprimanded in both cases.

Sheerness Dockyard.

It does not appear as if our anticipations with regard to the new floating dock will be realized, for according to present arrangements it is to be moored in Saltpan Reach and worked from Chatham. Should this decision be adhered to there will, it is certain, be many days during the winter months when work will be at a standstill through fogs, which are very thick at times. During a fog at the end of November the *Prinz Hendrik*, one of the Zeeland Company's mail steamers, collided with Torpedo Boat No. 35, and also with the tug *Security*, which were both berthed at buoys off the yard. The torpedo boat's stem was struck and twisted and one or two plates were also damaged, while the tug had some stays carried away, in addition to receiving damage to her hull. The process of strengthening the Nore Destroyer Flotilla is being continued, and during the next few weeks several more vessels will join, bringing the strength of the flotilla up to fourteen destroyers of the "River" class. The vessels yet to join are the *Rother*, on the delivery of the *Nautilus* from the Thames Ironworks Company, the *Foyle*, on the completion of her refit at Pembroke, the *Erne*, on completing her refit at Haulbowline, and the *Dee*, which is refitting at Devonport. The torpedo gunboat *Speedy* has been taken in hand for overhaul and refit, which is to include the retubing of her boilers. She is seventeen years old and she has been fifteen years in commission, and she was the first torpedo gunboat to be fitted with water-tube boilers. Her refit will cost over £11,000. The destroyer *Fervent* has been rather unfortunate lately. On November 26th she grounded on the Maplin Sands, being got off with some slight damage to her propellers. On December 9th while steaming through the harbour at dusk on her way to Chatham, where the court-martial on her commanding officer was held, the vessel ran into a mooring buoy, damaging her stem, which was flattened and bent. The vessel has been dry-docked for the repair of the damaged plates and stem. A few days later, while steaming into harbour to embark officers who were to attend the court-martial at Chatham, Torpedo Boat No. 46 was driven by the rough sea against the sea wall, her rudder being disabled. It is seldom that there is such a chapter of accidents in connection with a vessel in such a short time. The most serious accident of the month, however, was that which occurred to the special service vessel *Elfin*, tender to the *Thames*, depot ship of the Nore Submarine Flotilla. The flotilla was leaving Harwich Harbour on December 16th and the *Elfin* was conveying a number of liberty men to the *Thames*. When half way across the harbour the *Elfin* was struck abaft the bridge by Submarine *C8*, and sank in about seven minutes, five men being drowned. The *Elfin* is by no means a large vessel, but in such cases it is usually the submarine that suffers. Indeed, this is the first instance, it is believed, in which a submarine has sunk another vessel.

Pembroke Dockyard.

The cruiser *Blonde* now looks almost completed, she having had her mast, topmast, yards and rigging put in position and her four funnels erected. The work in the interior is also well advanced and the mountings for the ten 4-inch guns have been delivered, but at the time of writing the guns themselves have not arrived. Our latest vessel, the *Active*, is making satisfactory progress, but at present it does not appear as if she will be completely plated and riveted up by the end of December, so as to allow the contracting engineers to commence boring operations for the propeller shafting. The vessel will doubtless be ready early in January for Messrs. Hawthorn's workmen. It is understood that the *Active* will be launched in February. Preparations are going on for the commencement of the cruiser *Amphion*, the keel plate of which will be laid early in the new year. The destroyers *Cynthia*, *Avon* and *Locust* have left, their refits having been completed. Seven destroyers have recently been refitted at this yard, the other vessels being the *Greyhound*, *Violet*, *Sylvia* and *Osprey*. This shows that this establishment is admirably adapted for that class of work. The *Foyle* has also been completed and is leaving immediately for Chatham. Her refit included the retubing of her water-tube boilers, in addition to a most thorough overhaul. The vessel is six years old, and she is quite as effective a ship now as when she was first launched. We have still two destroyers in hand—the *Cheerful* and *Coquette*. The extension of the dry dock is being proceeded with and is progressing towards completion in a fairly rapid manner. When the work is finished we shall be able to dock two destroyers on end, or the dock will accommodate a vessel 435 ft. long—that is, 50 ft. longer than the vessels of the *Boadicea* class.

REVIEWS.

The Romance of the Ship. By E. Keble Chatterton. London: Seeley & Co., Ltd. Price 5/-.

FOR a popular history of the ship we have no hesitation in saying that this is the best book we have known published. The evolution of the ship is traced from the earliest times to the present date. The author opens his book with a chapter on the first ships of the Nile, followed by an account of the early ships of the Mediterranean. Separate chapters deal with the development of the ship up to the advent of steam. The first attempts in steam propulsion are described, and so we are led on to the modern ocean-liner and the man-of-war. The book contains thirty-three illustrations, not forgetting the ancient dug-outs, of a most interesting nature, and we congratulate the author on producing a most absorbing history of the ship which we can commend to all lovers of the sea and ships.

Steam Turbines, Their Design and Construction. By Rankin Kennedy. Whittaker & Co., London. Price 4/6 nett.

THIS small work is published for the use of engineers and students who may desire to obtain an insight into the methods whereby the principle dimensions of steam turbines are calculated referring to first principles. The first chapter gives most clearly and simply the theoretical, mechanical and physical problems of the jets issuing in the turbine and details the first formulæ of the thrust developed by those jets, and closes with formulæ expressing the mean diameter and the height of blade in inches. These are in a form that can be readily understood by any student who has learnt the elements of mechanics. Following is a chapter upon elementary turbines, which commences with the Hero wheel and then continues with Parson's first series of Hero wheels and Curtis wheels. This leads up to the De Laval wheels, in which the De Laval nozzle is fully explained and calculations are given by which the velocity of the steam at a certain point is well set out. A section and the various parts of the De Laval turbines are illustrated, by which the necessary parts can be well distinguished, and formulæ are given by which the force F. of such a turbine can be quite clearly estimated. In Chapter III. the author gives an excellent idea of the advantage gained by working turbine wheels in series, and shows that this idea originated with the Pilbrow turbine in 1843, and afterwards a Mr. Wilson in 1848 shows patented designs for a turbine working with some six wheels in series. These examples are followed by formulæ which express the horse-power and also the weight of steam consumed per horse-power hour. Then comes a cross-section of the Impulse Rateau turbine, and a sufficient literary explanation of the action of the steam, entering at high pressure, and expanding in each successive set of blades, is given. The introduction of dummy pistons with labyrinthine packing for balancing the pressures on the turbine is fully explained, with a full explanation and sections of the said labyrinthine packing. Parson's turbine is described, with complete illustrations, and a table of particulars of H.M. Cruisers *Amethyst* and *Topaze*, fitted with turbines and reciprocating engines. This chapter finishes with a full page illustration of a section of a high vacua condenser with augmentor which was taken from Mr. Gerald Storey's Cantor papers. We are told that the steam taken to work the augmentor is about 6 per cent. of the whole, but the gain in power is much more. The necessity of such vacuum augmentor or intensifier for use with exhaust steam turbines is insisted upon, and is further illustrated by Leblanc's high vacua jet vacuum augmentor. Chapter IV. is occupied by a description of some steam turbines, and finishes up with a description and illustration of a torsion meter and also of the Föttinger torsion indicator as applied to German cruisers. In Chapter V. there is to be found a series of illustrations and descriptions of the construction of turbine wheels, including detail sections of De Laval wheels, blades with their method of fixing, and a large half-page illustration of the Brush-Parson's turbine. Taking this book as a whole it is eminently adapted for the perusal of young engineers and students and will largely fill their want for a suitable text-book in steam turbines.

Summary of Shipbuilding Returns of United Kingdom in 1910, arranged in order of Tonnage built by each Firm.

No.	Name of Firm.	Place.	No. of Ships.	Total Tons.†
1	Harland & Wolff, Ltd.	Belfast	8	113,861
2	Swan, Hunter Wigham Richardson, Ltd.	Tyne	16	70,012
3	Russell & Co.	Clyde	12	66,402
4	Northumberland Shipbuilding Co., Ltd.	Tyne	10	50,080
5	Workman, Clark & Co., Ltd.	Belfast	8	49,993
6	Wm. Doxford & Sons, Ltd.	Wear	10	41,875
7	Barclay, Curle & Co., Ltd.	Clyde	6	33,544
8	Chas. Connell & Co., Ltd.	Clyde	5	32,771
9	Craig, Taylor & Co., Ltd.	Tees	7	31,850
10	Irving's Snipbuilding & Dry Docks Co., Ltd.	Hartlepool	8	31,440
11	Alexander Stephen & Son, Ltd.	Clyde	5	30,176
12	Palmer's Shipbuilding & Iron Co.	Tyne	3	30,010
13	Sir Raylton Dixon & Co., Ltd.	Tees	7	27,125
14	Ropner & Son	Tees	6	26,677
15	Wm. Denny & Bros.	Clyde	—	25,873
16	Short Bros., Ltd.	Wear	8	25,819
17	Richardson, Duck & Co.	Tees	7	23,576
18	Wm. Hamilton & Co., Ltd.	Clyde	7	22,825
19	Sir W. G. Armstrong, Whitworth & Co, Ltd.	Tyne	6	21,936
20	Scott's Shipbuilding & Engineering Co., Ltd.	Clyde	1	20,250
21	J. Readhead & Sons	Tyne	5	20,174
22	A. McMillan & Son, Ltd.	Clyde	5	20,008
23	John Brown & Co., Ltd.	Clyde	7	18,564
24	Vickers, Son & Maxim, Barrow, Ltd.	Barrow	—	18,130
25	Cammell, Laird & Co., Ltd., Birkenhead and Tranmere	Mersey	—	17,167
26	Earle's Shipbuilding & Engineering Co., Ltd.	Humber	11	15,915
27	D. & W. Henderson & Co., Ltd.	Clyde	3	15,492
28	Bartram & Sons	Wear	3	12,218
29	Robert Thompson & Sons, Ltd.	Wear	5	12,031
30	Tyne Iron Shipbuilding Co., Ltd.	Tyne	3	11,671
31	Sunderland Shipbuildng Co., Ltd.	Wear	6	11,401
32	Wm. Pickersgill & Sons	Wear	4	10,305
33	Wood, Skinner & Co., Ltd.	Tyne	5	9,407
34	Fairfield Shipbuilding & Engineering Co., Ltd.	Clyde	12	9,400
35	Greenock & Grangemouth Dockyard Co.	Clyde & Forth	7	9,277
36	Napier & Miller, Ltd.	Clyde	5	9,190
37	Clyde Shipbuilding & Engineering Co., Ltd.	Clyde	4	9,182
38	J. Blumer & Co.	Wear	3	8,643
39	C. H. Walker & Co., Ltd.	Chepstow	—	6,955
40	Wm. Beardmore & Co., Ltd.	Clyde	2	7,535
41	Hall, Russell & Co.	Aberdeen	13	6,955
42	Simons & Co., Ltd.	Clyde	6	6,322
43	A. Rodger & Co	Clyde	3	5,929
44	John Priestman & Co.	Wear	2	5,772
45	S. P. Austin & Son, Ltd.	Wear	3	5,750
46	Wm. Dobson & Co.	Tyne	3	5,475
47	R. Duncan & Co., Ltd.	Clyde	2	5,610
48	G. Rennie & Co.	Greenwich	28	5,441
49	Osborne, Graham & Co.	Wear	3	5,369
50	Ailsa Shipbuilding Co., Ltd.	Clyde	6	5,140
51	J. Samuel White & Co., Ltd.	E. Cowes	—	5,130
52	Smith's Dock Co., Ltd.	N. Shields	33	5,037
53	Blyth Shipbuilding & Dry Docks Co., Ltd.	Tyne	4	4,896
54	Lobnitz & Co.	Clyde	19	3,892
55	Wm. Harkess & Son, Ltd.	Tees	5	3,872
56	John Crown & Sons, Ltd.	Wear	3	3,785
57	Sir James Laing & Sons, Ltd.	Wear	1	3,753
58	Campbeltown Shipbuilding Co.	Clyde	3	3,594
59	Cook, Welton & Gemmell, Ltd.	Humber	15	3,561
60	Murdock & Murray	Clyde	11	3,526
61	Mackie & Thompson, Ltd.	Clyde	12	3,440
62	Caledon Ship & Engineering Co., Ltd.	Tay	4	3,258
63	Ferguson Bros.	—	7	3,050
64	John I. Thornycroft & Co., Ltd.	S'ton	—	2,934
65	Bow, McLachlan & Co., Ltd.	Clyde	13	2,924
66	Cochrane & Sons	Humber	17	2,978
67	Ramage & Ferguson, Ltd.	Forth	5	2,743
68	Dundee Shipbuilding Co., Ltd.	Tay	9	2,610
69	Scott & Sons	Clyde	9	2,505
70	John Fullerton & Co.	Clyde	7	2,344
71	Ritchie, Graham & Milne	Clyde	21	2,315
72	A. & J. Inglis, Ltd.	Clyde	3	2,109
73	John Chambers	Lowestoft	30	2,079
74	Henry Scarr	Humber	9	1,979
75	Alex. Hall & Co., Ltd.	Aberdeen (Dee)	9	1,885
76	Lytham Shipbuilding & Engineering Co., Ltd.	Lytham	13	1,863
77	R. Williamson & Sons	Mersey	3	1,745
78	A. W. Robertson & Co	Thames	17	1,655
79	The John Duthie Torry Shipbuilding Co.	Torry (Dee)	12	1,653
80	Ardrossan Dry Dock & Shipbuilding Co.	Clyde	3	1,632
81	Joseph T. Eltringham & Co.	S. Shields	5	1,546
82	W. H. Warren	Humber	10	1,490
83	Yarrow & Co., Ltd.	Clyde	6	1,384
84	Goole Shipbuilding & Repairing Co., Ltd.	Goole	5	1,348
85	George Brown & Co.	Clyde	8	1,167
86	Camper & Nicholson, Ltd.	Gosport	9	1,132
87	J. P. Rennoldson & Sons	Tyne	6	1,107
88	Dublin Dockyard Co.	Dublin	3	1,078
89	Hepple & Co., Ltd.	Tyne	7	1,006
90	Camper & Nicholson Ltd.	Gosport	9	1,132
91	Hepple & Co., Ltd.	Tyne	7	1,006
92	Thames Ironworks Shipb. & Eng. Co., Ltd.	Thames	1	970
93	London & Glasgow Shipbuilding Co.	Clyde	1	920
94	W. J. Yorkston & Sons	Mersey	—	712
95	Mackay Bros.	Forth	1	542
96	William Walker	Maryport	2	668
97	Crabtree & Co., Ltd.	Gt. Yarmouth	4	515
98	Cox & Co. (Engineers), Ltd.	E. Channel	4	427
99	Fellows & Co., Ltd.	Gt. Yarmouth	5	414
100	Garston Graving Dock & Shipbdg. Co., Ltd.	Mersey	2	396
101	Hawthorns & Co., Ltd.	Forth	3	378
102	Larne Shipbuilding Co.	Larne	2	170
*1	W. Gray & Co., Ltd.	Tees	13	60,377
*2	Joseph L. Thompson & Son, Ltd.	Wear	7	32,537
*3	Hawthorn, Leslie & Co., Ltd.	Tyne	7	27,400
*4	Fleming & Ferguson, Ltd.	Clyde	10	5,970
*5	Alley & MacLellan, Ltd.	Clyde	48	3,500

† Board of Trade gross tons register.
* Board of Trade gross tons register, including erections.

List of Vessels Launched in 1910

ENGLISH.

THE TYNE.

Sir W. G. Armstrong, Whitworth & Co., Ltd., Newcastle-on-Tyne.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Tremont, Screw Steamer	Steel	British	4,189	—	2,844
Tripoli ,,	,,	,,	4,186	—	2,844
Storstad ,,	,,	Foreign	5,086	—	3,492
Isturna ,,	,,	British	2,143	—	1,176
George V. ,,	,,	,,	188	—	720
H.M.S. Weymouth	—	,,	5,250	—	22,000

The Blyth Shipbuilding and Dry Docks Co., Ltd., Blyth.

Hopper Barge	Steel	British	470	—	—
† Ellerbeck	,,	,,	1,499	—	1,340
* Syndic	,,	,,	2,727	—	1,632
Crane Pontoon	,,	Foreign	200	—	—

W. Dobson & Co., Low Walker, Newcastle-on-Tyne.—3 steel screw steamers of a total gross tonnage of 5,475, and machinery of 4,642 I.H.P.

J. T. Eltringham & Co., South Shields.

Flying Kestrel, Pass. Tender	Steel	British	390	—	900
Great Central No. 1, Sc. Tug	,,	,,	136	—	730
Teme, Sailing Barge	,,	,,	346	—	—
Kenn, Sailing Barge	,,	,,	346	—	—
Deneside, Coaster	,,	,,	328	—	450

R. & W. Hawthorn, Leslie & Co., Ltd., Hebburn Shipbuilding Yard, Hebburn.

H.M.S. Scourge, Sc. Turbines	—	British	1,036dis.	1,036	12,500
Sir Ernest Cassel, Single Sc.	—	Foreign	7,774	7,774	2,825
H.M.S. Nemesis, Sc. Turbines	—	British	780dis.	780	13500
H.M.S. Nereide ,,	—	,,	780dis.	780	13,500
Port Curtis, Single Screw	—	,,	4,711	6,050	3,540
Port Keebla, Single Screw	—	,,	4,711	6,050	3,540
Stephen, Single Screw	—	,,	4,178	4,770	2,400

Hepple & Co., Ltd., Wapping Street, South Shields.

* No. 598, Screw Tug	Steel	British	65	—	200
Nos. 603 & 604, 2 Barges	,,	Foreign	138ea	—	—
* Bheestre, Tug & Waterboat	,,	British	60	—	200
† Boebva, Tug & Icebreaker	,,	Foreign	190	—	380
* Glenside Cargo Steamer	,,	British	260	—	300
T.I.C. No. 31, Hopper Barge	,,	,,	255	—	—

The Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne.

Brantford	—	British	4,650	—	1,800
Indian Transport	—	,,	4,650	—	1,800
Amosto	—	,,	4,820	—	2,000
Marengo	—	,,	6,270	—	2,800
Cape Transport	—	,,	4,650	—	1,800
Natal Transport	—	,,	4,650	—	1,800
Dalecrest	—	,,	4,800	—	2,000
Hova	—	,,	4,800	—	2,200
Francisco	—	,,	6,270	—	3,100
Wearbridge	—	,,	4,820	—	2,000

Palmer's Shipbuilding and Iron Co., Ltd.

Janus, Pass.	Steel	Foreign	4,824	—	2,900
Hercules, Battleship	,,	British	20,000	—	25,000
City of Bombay, Cargo	,,	,,	5,186	—	2,400

John Readhead & Sons, Ltd., South Shields.

Treverbyn	—	British	4,525	—	2,000
Elmmoor	—	,,	2,071	—	1,800
Indian Prince	—	,,	4,804	—	2,000
Usworth	—	,,	4,280	—	1,600
Lorca	—	,,	4,488	—	2,000

The machinery and boilers for the above vessels have also been built by the firm.

J. P. Rennoldson & Sons, South Shields.

† Cabrera Roca	Steel	Foreign	170	—	920
* Abeill VI.	,,	,,	115	—	475
* Abeille V., Twin-Screw	,,	,,	210	—	780
Telpher, Barge	,,	British	281	—	—
* Irena	,,	,,	257	—	785
* Souter	,,	,,	123	—	375
† George V. (engined only)	,,	,,	—	—	720

Smith's Dock Co., Ltd., Middlesbrough-on-Tees.

Yard No. 417, Screw	Steel	—	291	—	400
,, 418			242		470
,, 419			241		470
,, 420			22		440
,, 421, 422 & 423			510		240ea
,, 424, Twin-screw			59		600
,, 426 Screw			241		470
,, 427 ,,			127		300
,, 428 Twin-screw			482	—	840
,, 429 Screw	,,	—	23	—	125
,, 430, 431 & 432			760a	—	185ea

† Triple. * Compound.

Smith's Dock Co., Ltd., Middlesbrough-on-Tees. (Continued.)

Yard Nos. [illegible] & 436 ..			7,000		18[illegible]
,, 437 & 438 ..			7,000		1600d
,, 439 ..			[illegible]		200
,, 440 ..			[illegible]		18[illegible]
,, 441 & 442 built and shipped in sections			[illegible]		1600d
Yard Nos. 443, 444, 445, and 484, built and shipped in sections			[illegible]		
Yard No. 455, 456 & 457 ..			2,750a		4000d
,, 458 ..			10		585

Swan, Hunter & Wigham Richardson, Ltd., Wallsend and Walker-on-Tyne.

Name of Vessel	Built of	Owners	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Cartier, Twin-screw	Steel	Colonial	576	—	1,200
Carthage, Twin-screw ..	—	Foreign	54,02[illegible]	—	9,600
Sidi Brahim			[illegible]		4,500
Tadorna		British	[illegible]		1,500
Norbilda			1,374		870
Keystorm		Colonial	1,674		1,040
Harmattan		British	200		2,400
No. 340 do. Twin-screw			1,672		400
Bandon			[illegible]		2,600
Admiralty Caisson			1,902		
Floating Dock			6,440		
Indrabarah, Twin-screw			[illegible]		5,000
Franconia, do.	—	,,	10,150	—	14,500
Prince George, do		Colonial	572		9,000
H.M.S. Hope, 2 Sc		British	7800ds		1,500
Kioto	—		7,174		1,780

Tyne Iron Shipbuilding Co., Ltd., Willington Quay-on-Tyne.

Llandudno Screw .. .	Steel	British	4,187	4,040	2,400
Lancelia			4,748	4,[illegible]	1,542
Ingleside			4,[illegible]	4,[illegible]	1,543

Wood, Skinner & Co., Ltd., Newcastle-on-Tyne.

Blackoff, Schooner Rig	Steel	British	1,[illegible]	[illegible]	1,100
San Remo		Foreign	2,[illegible]24	1,[illegible]22	1,440
Towneley		British	2,47[illegible]	1,47[illegible]	1,524
Hamma		Foreign	1,[illegible]75	7[illegible]4	8[illegible]4
Marsden		British	2,481	1,477	1,524

WEAR.

S. P. Austin & Son, Ltd., Wear Dockyard, Sunderland.

Name of Vessel	Built of	Owners	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Largo, Screw	Steel	British	1,761		1,200
Sir Francis	..	..	1,991		1,200
Sir Arthur	..	..	1,[illegible]		1,280

Bartram & Sons, Sunderland.

Mozart, Schooner	Steel	British	1,427		1,[illegible]00
Cedar Branch, Schooner			[illegible]		2,500
† West Wales, Schooner ..	,,	,,	4,237	—	1,600

John Blumer & Co., North Dock, Sunderland.

Euston	Steel	British	2,811	[illegible]05	200NHP
Forestmoor			2,[illegible]44	2,[illegible]10	257
Boverton	,,	,,	2,958	3,190	267

J. Crown & Sons, Ltd., Sunderland.

Skipjack .	Steel	British	1,20[illegible]		8[illegible]0
Solent			1,[illegible]47		1,11[illegible]
Griplast	..	..	1,[illegible]04		[illegible]8[illegible]

William Doxford & Sons, Ltd., Sunderland.

Istina, Single Deck Ordinary		Foreign	3,[illegible]05		1,[illegible]0[illegible]
Quantock ,,		British	4,47[illegible]		2,150
Izrada ,,	—	Foreign	3,495		1,[illegible]00
Atland Single Deck Turret.	—	,,	5,068		2,200
Royal Crown, S.D. Ordinary	—	British	4,903	—	2,250
Izabran		Foreign	[illegible]0		1,[illegible]50
Windsor Hall		British	[illegible],[illegible]0[illegible]		1,4[illegible]0
Moorlands ,,	—	,,	3,600	—	1,480
Farn ..		,,	4,[illegible]00		1,600
Mediterraneo		Foreign	4,[illegible]4[illegible]		2,000
S.S. Æolus, engines & boilers	—	—			850
S.S. Orange Branch, boilers					1,500

Sir James Laing & Sons, Ltd., Sunderland.

Umona			[illegible],[illegible]8[illegible]		2,600

Osbourne, Graham & Co., Hylton, Sunderland.

Ladywood .	Steel	British	2,[illegible]14	2,42[illegible]	1,[illegible]4
Bogstad		Foreign	1,[illegible]0	[illegible],[illegible]01	1,000
Renee Marthe .			1,[illegible]40	1,[illegible]57	1,[illegible]0[illegible]

Wm. Pickersgill & Sons, Ltd., Sunderland.

Indutionare ..	Steam	Foreign	1,592	—	
British Standard ..		British	[illegible],4[illegible]		
West Quarter			1,[illegible]42		
Denewell .		,,	[illegible],[illegible]0[illegible]		

John Priestman & Co., Sunderland.

Eastern Prince	Steel	British	2,885	[illegible]00	2,300
Asiatic Prince		..	2,[illegible]87	[illegible],[illegible]2	2,208

Short Brothers, Ltd., Sunderland.

Scottish Prince	—	British	2,897	4,062	2,[illegible]0
Octo ..		Foreign	1,[illegible]17	1,770	975
Tern ..		..	1,[illegible]09	1,[illegible]81	[illegible]7
Anglo-Patagonian	—	British	5,016	6,673	2,880
Kendal Castle	—	,,	3,884	4,389	1,700
Fulgent			2,[illegible]08	2,107	1,200
Laristan			[illegible],075	4,[illegible]03	1,[illegible]00
Anticosti			[illegible],[illegible]0[illegible]	5,4[illegible]6	2,[illegible]0[illegible]

‡ Triple ; Turbine

Sunderland Shipbuilding Co., Ltd., Sunderland.

Ancona ..	Steel	British	3,708		1,[illegible]
Saskatoon	,,	,,	[illegible],[illegible]7[illegible]		[illegible]
Malmanger	,,	Foreign	1,[illegible]47		[illegible]
Signe			[illegible],[illegible]0[illegible]		1,[illegible]
Oakmere	,,	British	1,[illegible]41		1,[illegible]02
Thisbe .		Foreign	1,[illegible]05[illegible]		900

Joseph L. Thompson & Sons, Ltd., Sunderland.

Name of Vessel	Built of	Owners	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Mirosfield	Steel	British	5,202		2,[illegible]00
Pentwyn			[illegible],[illegible]47		2,000
Boyne			[illegible],424		[illegible],[illegible]00
Ariadne Christine			4,459		2,000
Linchuden ..			4,457		2,130
Daventry	,,	,,	4,487		[illegible],[illegible]00
Fenay Bridge	,,	,,	[illegible],[illegible]84		2,000

Robert Thompson & Sons, Ltd., Sunderland.

Triton Screw	Steel	Foreign	1,[illegible]58	1,406	[illegible]2[illegible]
Remembrance do.		British	[illegible],[illegible]00	4,067	2,000
Corbridge, do.		,,	[illegible],987	4,[illegible]16	2,040
Wedgwood and Kirkwood, do.		,,	1,[illegible]7[illegible]4	1,[illegible]0[illegible]4	1,[illegible]47[illegible]4

TEES AND HARTLEPOOLS.

Craig, Taylor & Co., Ltd., Stockton-on-Tees.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Bideford and Eggesford		British	[illegible],[illegible]00[illegible]		[illegible],[illegible]4[illegible]
† Benbrook, Bengrove and Benpark	—	,,	4,300ea	—	2,050ea
Thisbeban			[illegible],[illegible]00		2,[illegible]00
No. 142			180		2,100

W. Gray & Co., Ltd., West Hartlepool.

Zinovia		Foreign	[illegible],041		1,[illegible]00
Mohawkfield		British	[illegible],[illegible]35		[illegible]0
Harpagus			[illegible],[illegible]24		[illegible],[illegible]00
Joseph Chamberlain			4,140		1,[illegible]00
Djerissa and Camerata ..	—	,,	—	3,988ea	1,750ea
Fridland		Foreign	[illegible],[illegible]66		2,[illegible]00
Boukadir		British	[illegible],[illegible]88		1,[illegible]00
Ballistan and Registan			[illegible],[illegible]4[illegible]		2,[illegible]00ea
Harpathon			[illegible],[illegible]74		[illegible],[illegible]00
Ryburn			[illegible],[illegible]38		1,[illegible]00
Escrick			[illegible],[illegible]50		1,[illegible]50

Sir Raylton Dixon & Co., Ltd., Middlesbrough-on-Tees.

Ramsgarth .. .. Steam	Steel	British	1,553	1,580	1,200
Kwarra ..			[illegible],[illegible]4[illegible]	[illegible],[illegible]00	2,[illegible]00
British Transport			[illegible],[illegible]44	[illegible],[illegible]70	1,[illegible]50
Malaespina		Foreign	[illegible],[illegible]58	[illegible],[illegible]7[illegible]0	1,[illegible]40
Canadian Transport		British	[illegible],[illegible]33[illegible]	[illegible],[illegible]30	1,[illegible]50
Berwindmoor ..	,,	,,	5,232	6,250	3,500
Berwindvale			[illegible],[illegible]22	[illegible],[illegible]280	[illegible],[illegible]00

Irvine's Shipbuilding and Dry Docks Co., Ltd., West Hartlepool.

Tamele, Omitsha & Akassa		British	[illegible],[illegible]00[illegible]		2,400
Braanhandel		Foreign	[illegible],[illegible]00		1,[illegible]00
Lingfield		British	1,88[illegible]		[illegible],[illegible]00
Stephen Furness			[illegible],[illegible]70		[illegible],000
Thistleby			[illegible],[illegible]00		1,[illegible]00
Drebergen ..		Foreign	[illegible],[illegible]0[illegible]		1,[illegible]00

Richardson, Duck & Co., Stockton-on-Tees.

Sterndale Steamer .		British	[illegible],427	[illegible]67	1,[illegible]0[illegible]
Lundy			[illegible],[illegible]8[illegible]	[illegible],[illegible]61	1,[illegible]0[illegible]
Seawall			[illegible]947	[illegible],[illegible]61	1,[illegible]0[illegible]
Bampton			1,4[illegible]0	[illegible],[illegible]11	[illegible],[illegible]0[illegible]
Dalrazan			[illegible]	1,[illegible]0[illegible]2	[illegible],[illegible]00
Watermouth			1,4[illegible]7	[illegible],[illegible]0[illegible]	[illegible],[illegible]0[illegible]
Rotherhall			[illegible],[illegible]84	2,4[illegible]7	1,[illegible]0[illegible]

Ropner & Sons, Ltd., Stockton-on-Tees.

Bradford City		British	1,[illegible]88		1,[illegible]
Birchwood			[illegible],[illegible]4[illegible]		1,[illegible]00
Spilsby			[illegible],[illegible]0[illegible]		1,[illegible]00
Mordenwood			[illegible],527		1,[illegible]0[illegible]
Artemis		Foreign	[illegible],[illegible]20[illegible]		2,400
Liverpool		British	[illegible],[illegible]07		2,[illegible]00

HUMBER.

Cochrane & Sons, Selby.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Scotch Girl, Drifter	Steel	British	[illegible]6		16[illegible]
Lord Leitrim, Drifter .			74		[illegible]0
Torbay II., Golden Ring, and Incentive, Drifters			2[illegible]4		17[illegible]
Manx Prince, Trawler			220		1[illegible]0
Supernal, Drifter			82		175
Arian & Bereian, Trawlers			221[illegible]		1[illegible]0
S.L. Haldane, Trawler		..	2[illegible]0		[illegible]0
H.A.L. Russell, Trawler ..		..	2[illegible]0		1[illegible]0
Prince Victor, Trawler			207		40
Eileen Duncan, Trawler ..		..	223		4[illegible]
Wishful, Drifter		..	[illegible]82		175
Hull Trader, Steamer			250		[illegible]2
Alberia, Trawler			2[illegible]7		[illegible]0
Apar, Tug			[illegible]0		[illegible]0

† Triple.

Cook, Welton & Gemmell, Ltd., Beverley.

Name of Vessel	Built of	Owners	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Alberia, Steam Trawler ..	Steel	British	318	—	[illegible]
Recordo and Resono, Steam Trawlers			226ea		1,000ea
Dromio and Pericles, Steam Trawlers			207ea		250ea
Icegate Steam Trawler			221		450
St. John and Stornoway Steam Trawlers			207ea		250ea
Courtier Steam Trawler			180		700
Ettrick ..			125		570
Narval		Foreign	214		400
Corientes and Corythaix, Trawlers		British	279ea	—	[illegible]
Riby Steam Trawler			231		1,000
Renco Steam Trawler			226		450

Earle's Shipbuilding & Engineering Co., Ltd., Hull.

H.M. Tug Hellespont		British	415	1,500
Northesk			1,760	950
Dewdale and Avenright			1,000ea	1,000ea
Lalame			2,372	4,700
Darlington			1,358	2,600
Blackburn and Bury			1,040a	1,900ea
Comet, Hullcraft			1,247	
Normandy and Brittany			618ea	950ea
I.H.P. of Machinery for Renewals and ships built elsewhere				9,000

Goole Shipbuilding and Repairing Co., Ltd., Goole.

Thames, Cargo Steamer ..	—	British	404	—	800
Grosbeak, Steel Fleeter ..	—	,,	193	—	300
Tanager, Steel Fleeter			191		600
Trent	—	,,	530	—	480
Sergipe		Foreign	258		

Henry Scarr, Hessle

Flour Towing Barge	Steel	British	[illegible]	
* G.C.R.A. Steam Barge			150	75
* 6 Towing Barges			[illegible]ea	
* Roslyn Towing Barge			150	

W. H. Warren, New Holland, Lincs.

‡‡ Prudent Welland	Steel	British	91		400
Jennie (Lighter)			250		
R.W.Y. No. 7, H.M. Admiralty Store Lighter ..	..	,,	105	—	
Nos. 9 and 10 Lighter			2[illegible]ea		
The Sprite (Sail)	,,	,,	165	—	
Open Sail			14		
One Lighter	,,	,,	230	—	
Violet, Lighter	,,	,,	85		
Ferry Boat			7		

THAMES

Beaching Bros., Ltd., Great Yarmouth.

Name of Vessel	Built of	Owners	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Skibo Castle, St. Drifter ..	Wood	British	80	—	150
Young Henry, St. Drifter			[illegible]		225
Steam Drifter			[illegible]		[illegible]

John Chambers, Lowestoft, Suffolk.

Girl Nancy and E. A. B., Steam Herring Drifters ..	—	British	[illegible]		130ea
West Wight			74		160
Wenloch ,, ..	—	,,	72		150
Oakland ,, ..	—	,,	60		100
Pecheur ,, ..	—	,,	69		120
[illegible]			84		200
Maud Evelyn ,,			72		100
[illegible]			61		150
Bon Avenir ,, ..	—	,,	76		120
Smilax ,, ..	—	,,	81		150
Remembrance ,, ..		,,	81		200
* Bien Venu ,, ..	—	,,	79		150
Young Kenneth ,, ..			61		120
Jacob George ,,			60		120
* Conflet ,, ..		,,	64		120
[illegible]			72		150
King George V. ,,			66		150
[illegible]			72		120
Girl Annie ,, ..		,,	66		130
Freya Yacht ..	—		77		
Young Fred, Stm. Hng. Dftr.		,,	72		150
[illegible]			[illegible]		200
Select		,,	[illegible]		150
[illegible]			[illegible]		100
Foresight ,, ..	—	,,	[illegible]		150
No. 373 ,, ..			[illegible]		[illegible]
[illegible]			[illegible]		150
No. 378, Stm. Lighter ..		,,	[illegible]		25
No. 376, Stm. Herring Drifter		,,	[illegible]		150

And four motor passenger boats for French owners.

[illegible] † Triple.

Forrestt & Co., Ltd., Wyvenhoe, Essex.

Name of Vessel	Built of	Owners	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Low Pilsbrick, Motor Yacht	Steel		7		70
No. 626, Admiralty St. Launch	Wood		12		151
No. 627, Launch	Steel	—	5	—	—
No. 628-9, Gasoline Launches	Wood	—	6	—	30
No. 630, Motor Launch			2		
No. 632, Admiralty St. Barge			12		155
† Havengore, Launch	Steel	—	26	—	290
Sea King, House Yacht			10		
* No. 636, Tug			24		[illegible]
No. 638, Canoe					
No. 639 & 640, Barges			24		
No. 641, Tug			24		85
No. 640, Motor Launch ..	Wood	—	2	—	6
No. 645, Stern Wheel ..	Steel	—	98	—	220
No. 646, Motor Launch	Wood		1		4

Crabtree & Co., Ltd., Great Yarmouth.

* Thargate, Ketch		British	264	100
* Silver Queen, Arcady and SS. 124, Ketches			84ea	180ea

Edwards & Co., Ltd., Millwall.

No. 612	Steel		18	
No. 616			20	
Sir John Baker		British	15	70
Beryl			12	36
The Motoketch			109	40
Nile Pecanha		Foreign	20	140
Ormara			28	120
No. 623			11	
No. 624			14	
No. 626			48	
Selva			26	200
Rizcho		Foreign	160	235
Montevideo			240	320
Bolivar			45	140

Fellows & Co., Ltd., Great Yarmouth.

* Scotia	Wood	British	87	
* Lord Stradbroke			79	
* Girl Ellen			82	
* Eglet and Three Boys			83ea	

Edward Hayes, Watling Works, Stony Stratford.

‡‡ Brigand and Glaum, Twin-screw	Steel	Foreign	200ea		800ea
‡‡ Popular			22		70
‡‡ Vagrant			18		70
‡‡			19		70
‡‡ Midge			4		40

All the machinery for the above vessels was built by Mr. Hayes, as well as several sets of 55, 70, and 80 I.H.P. and about 12 sets of auxiliary ship's machinery.

James R. Piper, East Greenwich.

2 Thames Lighters	Steel	British	—	86ea	—
[illegible] Lighters				205ea	
6 Thames Lighters				134ea	
Oil light Tank Barge	Wood			40	

G. Rennie & Co., Greenwich.

Balbul, T.S. Turret Tug		British	80		210
Vaccity, Screw Tug			120		360
Hever, Motor Barge		Foreign	17		60
No. 1122, Launch	Steel		28		78
Lady Truscott, Steam Yacht	—	British	75	—	270
No. 1130, Stern Wheeler	—	Foreign	80	—	160
No. 1132, Motor Wheeler			47		160
6 Barges		British	24ea		
No. 1140		Foreign	130		
No. 1141			36		
4 Barges		British	24ea		
6 Decked Barges			[illegible]ea		
Acuria, Lighter	—	Foreign	65		
2 Whipping Barges		British	60ea		

A. W. Robertson & Co., Canning Town.

1 Coal Whipper with machinery		120	
1 Hopper Barge		[illegible]	
11 Lighters	Steel	18	

The Thames Ironworks Shipbuilding and Engineering Co., Ltd., Canning Town

H.M.S. Natusius, T.L. Destroyer	700	12,000

ENGLISH CHANNEL.

Camper & Nicholson, Ltd., Gosport.

Name of Vessel.	Built of	Owners	G.T. Regis.	G.T. inclu. erect.	I.H.P.
†¶ Miranda, Tw. St. Yacht	Steel	British	[illegible]		1,400
La Cigale, Motor Yacht	Comp.		124		104
Sylvana, Motor Yacht			[illegible]		47
† Idaho, St. Yacht	Wood		[illegible]		225
Hobby, Motor Yacht ..			[illegible]		11
Blue Bird, Sailing Yacht ..			[illegible]		
[illegible]			[illegible]		
[illegible]			[illegible]		
Lomico			9		14
Rincon, Motor Yacht			[illegible]		[illegible]

* [illegible] † Engines supplied by Messrs. J. I. Thornycroft & Co., Southampton
¶ Triple-expansion inverted direct-acting surface condensing

Cox & Co. (Engineers), Ltd., Shipbuilders, etc., Falmouth.

Name of Vessel	Built of	Owners	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* Admiralty Tank Steamer		British	[illegible]		[illegible]
* Single-screw Tug			23		84
* Admiralty Tank Steamer			[illegible]		200
* Single-screw Launch			16		80

Hartley Mead, East Cowes.

Eleven wood boats, motor launches and 20 tons yacht

Philip & Son, Ltd., Dartmouth.

Dumbo II. and Southampton	Steel	British	2 [illegible]		[illegible]
Pinnace	Wood	Admiralty	12		100
Vivid		British	20		80
Alva	Steel		110		60
Connie and Guanay	Wood	Foreign	80ea	—	200ea
Launch	Steel		8		25
Triple-Expansion Engines for S.Y. Idaho	—	—	—	—	250
C.S.C. Engines of various sizes					500

Simpson, Strickland & Co., Ltd., Dartmouth.

m No. 784, Launch			1		4
* No. 788					26
† No. 789			2		1
* No. 790			1		6
* No. 791			16		70
m Hukishook, Racing Launch			1		
No. 794, Launch			1		4
‡‡ No. 795			1		6
No. 797, Dinghy					
‡‡ No. 792, Launch			7		30
No. 797, Cutter			1		
Nos. 798 and 799, Cutter			4ea		
‡‡ No. 770, Launch			7		27
a No. 771					220
† No. 772			8		70
‡‡ Nos. 773, 774 and 775, Launch			6ea		25ea
† No. 776, Launch			2		10
‡‡ No. 777			14		80
* No. 778			4		70

George & Thomas Smith, Ltd., Rye.

King George, Dredger	Wood	British	500dw		
2 Trawlers	,,	,,	[illegible]ea		

Stow & Sons, Shoreham.

m Betty, Auxiliary Cutter Yacht	Wood	British	11		1

John I. Thornycroft & Co., Ltd., Woolston, Southampton.

H.M.S. Savage, Destroyer		British Admiralty	784		[illegible]
H.M.S. Larne			610		1,[illegible]
H.M.S. Lyra			610		13,800
H.M.S. Martin			610		1,[illegible]
Baron Horace Guinzburg, Paddle Steamer		Foreign	200		800
A number of Tugs, Launches and Shallow Draught Vessels ..		British & Foreign	1,[illegible]		1,[illegible]

All engined by John I. Thornycroft & Co., Ltd.

J. Samuel White & Co., Ltd., Cowes, Isle of Wight.

Torpedo Boat Destroyers, Shallow Draught Vessels for special service, special Steamboats for War-ships		British and Foreign Govts.	8,130		96[illegible],00

White Bros., Itchin, Southampton.

m Dulga, Aux. Ketch			110		40
m Clarrie			24		60
m Sir Richard Mayne			17		120
m Sarrita, Aux. Cutter			14		6
Smlsd. Cutter ..			10		

BRISTOL CHANNEL.

Isaac J. Abdela & Mitchell, Ltd., Brimscombe, Stroud.

Name of Vessel	Built of	Owners	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Dora	Motor	Not known	7		[illegible]
Abelha	Steam		[illegible]		25
Emma	..	Foreign	8		20
Tapuia		..	25		80
D. Benvinha		..	8		30
Freda	..		1		
Shishaputa					
Dolly	Motor	Not known	[illegible]		
Umao	Steam	Foreign	[illegible]		12
No. 1216	Motor	Not known	4		12
Bretesstro	Steam	Foreign	[illegible]		[illegible]
Asturiana	..	..	20		80
Fortaleza	,,	,,	9	—	40
Aripuana	Motor		4		12
Meran			[illegible]		[illegible]
Pauhy	Steam		[illegible]		12
Valparaiso and Cassino Reis			[illegible]		[illegible]
Nos. 1224 & 1226a			2 [illegible]		[illegible]
No. 1237		Not known	[illegible]		[illegible]
No. 1238		Foreign	11		[illegible]

Finch & Co., Ltd., Chepstow.

No. 270, Sailing Barge		Foreign	90		
* The Forester, Cargo Steamer		British	350		[illegible]

Caisson, Floating, for Devonport Dockyard. Also several Coaling Lighters for shipment abroad.

* Compound. † Triple. ‡‡ Compound Surface Condensing. *a* Quadruple. *m* Motor.

C. H. Walker & Co., Ltd., Sudbrook Shipyard, Mon.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Admiralty Horse Boat, S78, Towing	Steel	British	[illegible]		
Admiralty Store Barge, Towing..	,,		[illegible]		
Gaivota, Steam Yacht ..	,,		40		[illegible]
Admiralty Victualling Lighter, Towing, R.W.Y., No. 8			[illegible]		
J. Constant I. and II., 2 Hopper Barges, Steam ..			[illegible]		[illegible]
15 Square Sections	,,	Foreign	[illegible]		

MERSEY.

Isaac J. Abdela & Mitchell, Queen's Ferry, nr. Chester.

Name of Vessel	Built of	Owners	G.W. Regis.	G.T. inclu. erect.	I.H.P.
* No. 302, Sloop	Steel				[illegible]
m No. 303	..				[illegible]
m Nos. 304 and 308	Wood	—	—	—	60ea
m No. 305	..				80
No. 306, 310 & 311 Sailing	Steel	British			
m No. 307	Wood	Foreign			80
* No. 309	..				
* No. 312					[illegible]

Cammell, Laird & Co., Ltd., Birkenhead Ironworks.

* Wolverine and Racoon. Torpedo Boat Destroyers.	Steel	British	802ea	—	12,500ea
† John Joyce and Snowdrop, Ferry Boats	,,	,,	440ea	—	* 1,200ea
* Ieracles, Tugboat		Foreign	114		[illegible]
6 Barges		British	252		
4 Barges			168		
Caisson		Foreign	80		
Poling Canoe			2		
Lighter			[illegible]		
Poling Canoe			2		
* Sertanejo, Amazon Str.			292		[illegible]
Ceara, Amazon Str.	,,		400		20
Barge	..		28		
6 Sets of Frameworks		,,	144		

Tranmere Shipyard.

Snicfell, T.S.S.	Steel	British	1,68[illegible]		[illegible]
† Cæsarea & Sarma, Turbine SS.		..	1,450[illegible]		6,[illegible]
† Highland Brae, SS.	,,	,,	7,365	—	4,400
Ex Blanca, Barge		Foreign	1,[illegible]		

Garston Graving Dock & Shipbuilding Co., Ltd., Garston, Liverpool.

† Musquash, Sloop Tug	Steel	British	195		750
* Gopher			[illegible]		700

One Pontoon, 101 ft. m. × 12 ft. × 8 ft. 6 in.

Isaac Pimblott & Sons, Northwich.

2 Lighters	Steel	Foreign	68 [illegible]ea		
* Steamer		..	6[illegible]		120
Lighter			[illegible]		
2 Lighters			Steel		
2 Lighters			[illegible]ea		
Lighter			[illegible]		
Lighter		..	10		
2 Launches			[illegible]ea		220 [illegible]
Lighter			19		
2 Lighters			Steel		
2 Lighters			[illegible]ea		
2 Lighters			[illegible]		
2 Launches			[illegible]ea		[illegible]
Lighter			[illegible]		
Lighter		..	21		

Vickers, Sons & Maxim, Ltd., Barrow-in-Furness.

H.M.S. Lion (Machinery only)	British Government.
Floating Dock, Alfonso Penna	Brazilian Government.
Tug Laurindo Pitta	Brazilian Government.
Various small vessels.	
Total	18,130
Total Indicated Horse-power	[illegible]

William Walker, Maryport, Cumberland.

Enchilte	Steel	British	[illegible]		[illegible]
Leitch			[illegible]		[illegible]

R. Williamson & Sons, Workington, Cumberland.

* Glanovanta	Steel	British	[illegible]		
Ingstad			[illegible]		
Calcaria			[illegible]		

W. J. Yarwood & Sons, Northwich, Cheshire.

Pontoon, with erection for transshipping gram	Steel	British	[illegible]		
* Yareata, Screw Launch Tug		Foreign	[illegible]		
* Crescent, Screw Steamer, Coasting type	,,	British	240	—	250
Om, Steam Screw			[illegible]		[illegible]
* Sky, Steam Screw			[illegible]		[illegible]
* Steam Tugs			[illegible]ea		[illegible]
Steel Tank Barge			[illegible]		
Galvd. Steel Barge	,,	Foreign	58	—	—
Steel Barge		British	[illegible]		
m 1 Tug			[illegible]		[illegible]
m Petrol Derrick Vessel ..	Steel	British	5	—	8
Twin set Engines—one marine					
Boiler					
1 Set Engines—one de					

* Compound [illegible] Triple. [illegible] Motor [illegible]

THE RIBBLE.

Lytham Shipbuilding and Engineering Co., Lytham, Lancs.

Name of Vessel	Built of	Owners	G.T. Regis.	G.T. inclu. erect	I.H.P.
Ozuta Twin Screw Cargo Steamer	Steel	British	153		320
Eddystone Single screw Barge		Foreign	abt		60
Canoes			45ea	—	
Tugwell Stern-wheel Steamer		British	187		150
Gdv Towing barge		Foreign	abt		
Britannia Single screw Launch			abt		abt
Sunderland Single screw Tug		British	abt		abt
Francesco Amazon River Passenger and Cargo Steamer		Foreign	247		300
Argonaut do			214		320
Muchique do			296		420
Alto Alto do			abt		440
Cassia Reis do			abt		abt

ROYAL DOCKYARDS.

H.M. Dockyard, Chatham.

H.M. Tug Dim, H.M. Tug Alliance, Mooring & Salvage Lighter	Launched.
C 109, late Acheron	Converted into a coal depot.
H.M.S.'s Naiad & Intrepid	Converted into Mine Layers.
H.M. ships London, Irresistible, Cressy, Euryalus Vindictive, Panther, Eden	Have undergone large refits.

Several vessels have undergone small refits.

H. M. Dockyard, Devonport.

Name of Vessel	Built of	Owners	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Lion Signal M.L.		H.M. Govt.	Steel		

H. M. Dockyard, Pembroke.

H.M.S. Cleopatra

H. M. Dockyard, Portsmouth.

Orion

LIST OF VESSELS ENGINED IN 1910.

Amos & Smith, Ltd., Hull.

Name of Vessel	Builders	I.H.P.	Press. lbs.
† Livorno	Earle's Shipbuilding & Eng. Co. Ltd.	1,100	
Como		700	
Lois	Cochrane & Sons		
H.A.L. Russell		500	
Alberta			
Dromio & Pericles	Cook, Welton & Gemmell, Ltd.	2700ea	
St. John & Stornaway		2800ea	
Vnouk	Foreign		
	Total	4,040	

Baird Bros., North Shields.

Central No. 1	Jos. T. Eltringham & Co.	700	150
Wheat Stalk	Geo. Stephen	200	140

Blair & Co., Ltd., Stockton-on-Tees.

Larchwood	Wm. Harkess & Son	700	
Sterndale and Lundy	Richardson, Duck & Co.	1,750ea	
Birchwood	Ropner & Sons, Ltd.	1,400	
Biskargi Mendi	Euskalduna Co., Bilbao	1,500	
Spilsby	Ropner Sons, Ltd.	1,[illegible]	
Llandudno	Tyne Iron Shipbuilding Co.	2,300	
Penwyn, Ariadne Christine and Fenay Bridge	J. L. Thompson & Sons	2,000ea	
Seawall	Richardson, Duck & Co.	1,650	
Rotherhill		1,850	
Mordenwood	Ropner & Sons, Ltd.	1,650	
Malaspina	Sir R. Dixon & Co.	1,450	
Bampton and Watermouth	Richardson, Duck & Co.	2,650ea	
Thistleban	Craig, Taylor & Co.	2,250	
Boyne	J. L. Thompson & Sons	2,250	
Dalveen	Richardson, Duck & Co.	2,200	
Arlesey	Ropner & Sons, Ltd.	2,500	
Beverley	Blumer & Co.	1,600	
Denewell	W. Pickersgill & Sons	1,800	
	Total	41,[illegible]	

In addition new boilers for Steam Trawlers have been built, aggr. 1,400 I.H.P.

Central Marine Engine Works, West Hartlepool.

Zinnia	Pirates	1,[illegible]	
† Mohawk	West Hartlepool	1,[illegible]	
Hampton Hall	London	[illegible]	
Josephine	West Hartlepool	1,800	
Dorothea and Edward			
Boukadra	Swansea	1,7[illegible]	
Brollo	Gothenburg	[illegible]	
Baltic	Swansea	[illegible]	
Rylon	West Hartlepool	1,[illegible]	
Escrick	London	1,750	
	Total	[illegible]	

‡ Triple * Compound

George Clark, Ltd., Sunderland.

S.S.'s Sir Francis, Largo, Sir Arthur, Kendal Castle, Eastern Prince, Remembrance, British Standard, Blacktoft, Daventry, Fulgent, Umona, Bogstad. Total N.H.P. by Lloyd's Rules, 3,366. Estimated I.H.P., total 21,500

Crabtree & Co., Great Yarmouth.

Name of Vessel	Builders	I.H.P.	Press. lbs.
* S.S. Friargate, Coaster	Crabtree & Co., Ltd.	400	150
* 3 Vessels, Drifters		540	140
* 3 Vessels, Drifters	Fellows & Co., Ltd.	540	140
* 2 Vessels, Drifters	J. Chambers	360	140
* 1 Vessel, Drifter	S. Richards & Co., Ltd.	180	140
1 Vessel, Drifter		200	180
* 1 Vessel, Drifter	Beeching Bros., Ltd.	180	140
* 7 Vessels, Drifters	Cochrane & Sons	1,260	140
† 1 Vessel, Coaster		420	170
* 1 Vessel, Tug		278	150
2 Vessels, Tugs,	Garston Graving Dock & S.B.Co. Ltd.	1,400	180
* 1 Vessel, Amazon Str.	Edwards & Co., Ltd.	278	140
* One Vessel	J. Pinkbott & Sons	130	150
* 1 Vessel, Tug	G. Rennie & Co.	378	150
* 1 Lighter and 1 Auxiliary Boat		77	120
	Total	6,400	

Crabtree & Co., Great Yarmouth.

5 Engines, Triple expansion		800
6 Engines, Compound		1,280

John Dickinson & Sons, Ltd., Sunderland.

S.S.'s Euston, Forestmoor, Mozart, Asiatic Prince, Leucadia, Ingleside, West Wales, Luncluden, Cedar Branch, Larristan. Total, Lloyd's N.H.P., 1,425. In addition to the above, 5 extra boilers have been built

Great Central Co-operative Engineering and Ship Repairing Co., Ltd., Grimsby.

† Arian, St. Trawler	Cochrane & Sons, Selby	400	160
† Bereian, ,,	,, ,,	400	150

G. T. Grey, South Shields.

† * Boomberg Cargo Steamer	A. Vuyk & Sons, Holland	900	
†* Chassis Mærsk, ,,	,, ,,	800	
†* Whaler	Kaldnæs Mek. Værksted	40	
* Deneside, Cargo Steamer	J. T. Eltringham & Co.	380	
†* Suction Dredger	Gleyers' Shipbuilding Co., Holland	[illegible]	
* Underwriters & Richard Grech, Screw Tugs	A. Vuyk & Sons, Holland	700ea	
†* 2 Whalers		420ea	
	Total	[illegible]	

R. & W. Hawthorn, Leslie & Co., Newcastle-on-Tyne.

† H.M.S. Scourge, T.B.D.	British Admiralty	12,500 S.H.P.	
† H.M.S. Nemesis & Nereide, T.B.D.		13,500ea	
† H.M. Protected Cruiser Weymouth (boilers only)		22,000	
	Total	[illegible]	

C. D. Holmes & Co., Hull.

Nemrod	Cook, Welton & Gemmell	450	200
Alberta		550	180
† Recordo, Resono, Repro and Renco		42[illegible]	180ea
† Corientes & Corythaix		550ea	198ea
Courtier		375	180
Trict		550	200
Narval		425	200
Ruby		425	180
† Manx Prince	Cochrane & Sons	425	180
Prince Victor		400	180
S.S. Haldane		60	200*
† Eileen Duncan		425	180

MacColl & Pollock, Ltd., Sunderland.

Triton	R. Thompson & Sons	850	180
* Indutiomare	W. Pickersgill & Sons	1,100	180
Cingetorix	Antwerp Engineering Co.	1,000	180
* Unison and Rochomie	Smith's Dock Co., Ltd.	1400ea	140ea
Adeli	Smith's Dock Co. Ltd.	650	180
† S.S. No. 142	Craig, Taylor & Co., Ltd.	2,100	180
Perdita	Mackay Bros.	800	180
	Total	6,820	

Mersey Engineering Works Co., Ltd., Liverpool.

32 ft. Steel Launch for British Colonial Petroleum Coy., London	Mersey Engine Works	20	120
†† 32 ft. Steel Launch for Elder, Dempster & Co.	,, ,,	20	120
† 3 32-ft. Steel Launches for Elder, Dempster and Co., Ltd., Strs.	,, ,,	20	120

A. G. Mumford Ltd., Culver Street, Engineering Works, Colchester.

†† Steam Launches Tugs, and small Yachts, 14 sets	Various	2,300	

* Compound † Triple ‡ Turbine. / Twin Triple. ** Triple Compound
/ Compound Non-Condensing. † Twin Compound

North-Eastern Marine Engineering Co., Ltd., Wallsend and Sunderland.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
Anglo-Patagonian (Quadruple)	London	2,880	
Anticosti	Liverpool	2,996	
Anerley	London	1,860	
Benbrook, Bengrove and Benpark	Liverpool	2,080ea	
Bideford	Cardiff	1,980	
Bradford City	,,	1,850	
Christopher	Liverpool	2,202	
Cydonia	North Shields	1,850	
Corbridge	Cardiff	2,040	
Esturia	London	1,176	
Ellerbeck	Newcastle	1,345	
Eggesford	Cardiff	1,980	
Gripfast	Newcastle	985	
Hova	London	2,202	
Kwarra	Liverpool	2,880	
Kamma	Copenhagen	834	
Keystorm	Ontario	1,038	
Keret	Archangel	792	
Kirkwood	London	1,475	
Ladywood	,,	1,645	
Marsden	Newcastle	1,524	
Marie	Esbjerg	485	
Malmanger	Bergen	950	
Nora	Esbjerg	485	
Norhilda	Bristol	864	
Octo	Christiania	975	
Oakmere	Manchester	1,025	
Port Curtis (Quadruple)	London	3,840	
Port Kembla ,,	,,	3,840	
Renfe Marthe	Caen	1,035	
Sir Ernest Cassel	Stockholm	2,825	
Storstad	Stavanger	3,492	
Syndic	Glasgow	1,632	
San Remo	Christiania	1,416	
Stephen	Liverpool	2,400	
Skipjack	Newcastle	890	
Solent	Sunderland	1,115	
Scottish Prince	Newcastle	2,335	
Saskatoon	Sunderland	935	
Signe	Tonsberg	1,395	
Tenger	Austria	852	
Tremont & Tripoli	Liverpool	2,844ea	
Towneley	Newcastle	1,524	
Terno	Arendal	975	
Thesbe	Caen	900	
West Quarter	Newcastle	1,345	
Wedgewood	London	1,475	
		85,156	

New Boiler.

Wasaw	Pernau	205	
	Total	85,361	

44,826 I.H.P. being constructed at the Wallsend Works, and 40,535 at the Sunderland Works.

The Parsons Marine Steam Turbine Co., Ltd.

t H.M.S. Rattlesnake	London & Glasgow Engineering and Iron Shipbuilding Co., Ltd.	–	–
t H.M.S. Weymouth	Sir W. G. Armstrong, Whitworth and Co., Ltd.	–	–
S.S. Vespasian	(Re-engined with geared turbines) Total, 35,500.	–	–

J. P. Rennoldson & Sons, South Shields.

† Cabo da Roca	J. P. Rennoldson & Sons	620	–
* Abeille VI.	,,	375	–
†† Abeille V.	,,	750	–
Telpher, Barge	,,		
* Irena	,,	385	–
* Souter	,,	375	–
† George V. (engines only)	Sir W. G. Armstrong, Whitworth and Co., Ltd.	720	–
	Total	3,225	

Richardsons, Westgarth & Co., Ltd., Hartlepool.

S.S. Indrabarah (Twin Screw)	5,000	–
S.S.'s Berwindmoor and Berwindvale	3,500ea	–
S.S. Stephen Furness	3,000	–
S.S.'s Tamele, Onitsha and Akassa	2,400ea	–
S.S.'s Lingfield and Maresfield	2,300ea	–
S.S. Kaduna	2,250	–
S.S.'s Ariosto, Dalecrest, Wearbridge and Argentine Transport	2,000ea	–
S.S. Thistletor	1,900	–
S.S.'s British Transport and Canadian Transport	1,850ea	–
S.S.'s Indian Transport, Cape Transport, Natal Transport and Brantford	1,800ea	–
S.S. Ramsgarth	1,200	–
S.S. Lisbon	1,150	–
S.S.'s Brandenberg, Oldenberg, Madgeberg, Graanhandel, Driebergen and Ubbergen	1,000ea	–
S.S.'s Hopeful and Norfolk Coast	800ea	–
S.S. London Queen	650	–
S.S. Teeswood	480	–
S.S. Vittorio Emmanuel	250	–
Barge	175	–
	61,325	

t Turbine † Triple. * Compound. †† Twin Compound.

Richardsons, Westgarth & Co., Ltd., West Hartlepool.—*continued.*

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
S.S. Manchester Spinner (engines only)		2,000	–
Steam Turbines		8,340	–
Steam Blowing Engines		3,000	–
Marine and Water Tube Boilers		10,850	–
	Total	88,815	

The Shields Engineering and Dry Dock Co., Ltd., North Shields.

* S.S. Flying Kestrel, Passenger Tender	910	–
† 215 Contract, Trawler	670	
† G.M., Trawler	480	
† Serra D'Agrella, Trawler	510	
† Roche Castle, Trawler	510	
* Priestman, Dredger	425	–
† Hananui, Whaler	425	–
* Rosa, T.S. Cargo Boat	540	–
* Dean Forest, Liscannor and Multistone, Cargo Boats	415ea	–
* Lassi Main, Five and Ten, Drifters	255ea	–
* E.J.M., Deliverer, Eminent, Water Bird III., Good Design II., Mary Thompson, Dairlie, J.A.C., Chris, Lloyd George and Contract 219, Drifters	195ea	
* Launch	130	–
* S.S. Barao de Cometa, T.S. Amazon Steamer	560	–
* Contract 221, Amazon Boat	470	–
† Contract 222, Trawler	560	–
† Picton Castle, Trawler	510	–
† Contract 214, Trawler	510	
Total	11,305	

Simpson, Strickland & Co., Ltd., Dartmouth, Devon.

‡‡ ———	Abroad	30	150	
———	,,	25	150	
———		9	150	
‡‡ Tessa	Meakes & Redknap	25	150	
‡‡ ,,	Abroad	34	150	
† Launch		26	250	
‡‡ ,,		6	150	
———		2	150	
a ,,	Abroad	70	250	
‡‡ ,,	Replaced Motor.	11	150	
‡‡ Brown Mouse		23	150	
† Launch	Abroad	26	250	
	Boilers only	372		
		681		

Sisson & Co., Ltd., Gloucester.

‡‡ Forester, Trading Steamer	Edward Finch & Co., Ltd.	250	120

Have also completed during 1910 about 2,550 Brake H.P. "Sisson" enclosed self-lubricating engnies.

The Vauxhall and West Hydraulic Engineering Co., Ltd., Luton, Beds.

‡‡ Two Steam Lighters	Foreign	620	160	
‡‡ 80 Crane Barge	British	Twin	45	140
‡‡ Steam Barge	,,		150	130
‡‡ Passenger Launch	,,		0	130
‡‡ Passenger Launch	Foreign	Twin	80	130
† Land Engine (Mill)	Driving English Mill		400	200
‡‡ Small Launch	Foreign		30	130
‡‡ 2 Passenger Launches	British		100ea	130ea
f 2 Small Tugs	,,		60ea	130ea
† Harbour Master's Vessel	,,		300	180
‡‡ Fast Launch	,,		200	160
f Tug	Foreign	Twin	160	140
‡‡ Tug Passenger Boat	,,	Twin	250	140
‡‡ Stern Wheel Vessel	British		150	140
‡Steam Barge	,,		150	150
‡‡ Tug	Foreign		140	130
‡‡ Passenger Tug	British		350	140
‡‡ Passenger Launch	,,		80	130
	Total		3,830	

The Wallsend Slipway and Engineering Co., Ltd., Wallsend-on-Tyne.

t H.M.S. Orion	Portsmouth Dockyard	27,000	–
S.S. Kioto, Single-Screw	Swan, Hunter & Wigham Richardson, Ltd.	3,550	–
S.S. Prince George, Twin-Screw		6,500	
t H.M. T.B.D. Hope	,,	13,500	
S.S. Franconia, Twin-Scr.	,,	14,500	–
S.S. Hodder, Single-Scr.	Messrs. Dobson & Co.	2,200	–
	Total	67,250	

W. & F. Wills Ltd., Bridgewater.

S.S. Sir Joseph Rhymer	Hull and propelling machinery by Hepple & Co., Ltd.	–	
	Eroding plant by W. & F. Wills, Ltd., Bridgewater	110	160

* Compound. *t* Turbine. † Triple. ‡‡ Compound Surface Condensing.
a Quadruple. *f* Compound Non-Condensing.

SCOTCH.

THE CLYDE, Etc.

Ailsa Shipbuilding Co., Ltd., Troon and Ayr.

Name of Vessel	Built of	Owners	G.T. Regis.	G.T. inclu. erect.	I.H.P.
S.S. Comrade	..Steam Steel	British	1,171	-	1,000
T.S.S. Hauba	..	Foreign	1,841		1,900
T.S.I. Stockton	.. ..	British	408		900
T.S.S. Ilhees	.. ..	Foreign	760	--	1,200
T.S.S. Cannavielras ..	.. ..	..	760	—	1,200
T.S.S. Valencia	.. ..	..	160	-	200

Alley & MacLellan, Ltd., Polmadie.

26 Barges	Steel	Foreign	—	2,648	
17 Pontoons ..		..	..	-	420	-
* 2 T.S. Steamers		..	..	—	280	700
* 1 S.S. Steamer ..		..	..	—	50	100
* 1 S.W. Steamer ..		..	..	-	60	80
1 Ferry		..	..	-	42	

Ardrossan Dry Dock and Shipbuilding Co., Ltd., Ardrossan.

No. 249, Ship, Paddle ..	Steel	British	421		500
† Canonbar, Single-screw ..	..	Colonial	720	—	700
* Manambar, Twin-screw ..		..	487		600

Barclay, Curle & Co., Ltd., Whiteinch, Glasgow.

Garth Castle, Twin-screw Boat ..	-	British	7,800		4,700
Hubert, Single-screw Boat ..	--	..	3,780		2,700
City of Chester, do.	—	..	3,824		3,300
Kursk, Twin-screw Boat ..	—	Foreign	8,200	—	6,900
Chilka, do.	-	British	1,420		4,200
Cocanada, do.	-	..	4,120		4,200

Also engined by Barclay, Curle & Co. Ltd.

William Beardmore & Co., Ltd., Dalmuir.

H.M.S. Falmouth	-	British	5,200tds		25,000
T.S.S. Shieldhall	-	..	2,500tds		1,500

Bow, McLachlan & Co., Ltd.

Volo, Steam Yacht	—	British	157	—	350
H.M.S. Resource, Screw ..		..	390		600
Mainstay, Forestay & Jackstay Screws		Foreign	44ea		18ea
Princess Mary, Twin-Screw ..		Colonial	1047	—	2,800
2 Lighters	--	..	203ea		
Pontoon	-	Foreign	62	—	-
.. ..	-	..	71		
H.M.S. Alliance, Hull built in H.M. Dockyard ..	-	British	—	-	1,600
H.M.S. Firm ..	—	..	—	—	1,400
Hull built in Colonies ..	—	Colonial	—	—	3,130

George Brown & Co., Greenock.

Nos. 58, 59 and 60, T.S.S. ..	—	—	110ea	—	—
No. 61, S.D.		Foreign	46	—	—
No. 62, S.Y.	-	British	40		—
Nos. 63 and 64, T.S.S. ..			112ea		
No. 65 S.S.	-	-	170		-

John Brown & Co., Ltd., Clydebank.

† Bristol, 2nd-class Cruiser ..	—	British Admiralty	4,850	—	22,000
† Acorn T.B. Destroyer		..	740	--	13,500
† Alarm	—	..	790	—	13,500
† Brisk	--	..	790	--	13,500
Doris, Steam Yacht	—	British	910	—	2,500
† St. Petersburg, Triple-screw Steamer	—	..	2,448	--	9,000
Preussen, Single-screw Steamer	-	Foreign	7,986	--	2,700

The Campbeltown Shipbuilding Co., Campbeltown.

† Plutus S.S.	Steel	British	1,189	1,289	
† Anna S.S. ..	..	Foreign	1,196	1,296	
† Boreas S.S.	..	..	1,204	1,300	--

D. M. Cumming, Glasgow.

4 Barges			1 tagge		—
Motor Barge ..			56		10B.H.P.

Clyde Shipbuilding and Engineering Co., Ltd., Port Glasgow.

D. A. Gordon S.S.	—	Colonial	2,301	—	1,000
A. E. McKinstry, S.S. ..	—	..	1,964	—	1,000
Renvoyle, S.S.	—	..	1,830	—	1,000
Scout Steam S.S.		Foreign	3,887	—	2,500
Sheik Mohamed					1,500

William Denny & Brothers, Leven Shipyard, Dumbarton.

Pinehurst, T.B.D.		British	887	--	-
Yarra, T.B.D.		Colonial	917	-	—
Sturgeon, T.B.D.		British	870		—
Rotoiti, C.S.S.		Colonial	11,150		—
Chiswick, S.S.		British	6,254	-	—
Argentine Reform	—	British	4,128		—
Cattistock, M.L.		..	..	—	—
Light Draught Vessels, steel pontoon and punt		Foreign	1,771		-

Duncan & Co., Ltd., Brown Street, Port Glasgow.

† Olga, Screw Steamer	Steel	Foreign	2,662	—	1,500
† Lucia, Screw Steamer	..	British	2,648	—	1,750

* Compound. † Triple. ‡ Turbine.

Charles Connell & Co., Ltd., Scotstoun.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Indradeo, S.S.	—	British	5,559	—	3,000
Student, S.S.	—	..	3,579	—	1,850
Saturnia T.S.S.	—	..	8,611	—	5,400
Knight Companion, S.S. ..	—	..	7,433		3,200
Explorer, S.S.	—	..	7,698	-	4,200

The Fairfield Shipbuilding and Engineering Co., Ltd., Govan, Glasgow.

H.M.S. Mosquito & Scorpion Tor. Boat Destroyers ..	—	Brit. Govt.	—	—	—
H.M.A.S. Parramatta and Warrego, T.B.D's.	—	Colonial		-	-
H.M.S. Cameleon, Comet, and Goldfinch, T.B.D.'s	—	Brit. Govt.	—	—	—
Princess Adelaide S.S. ..	—	Colonial	—	—	—
Bosphorus 65, T.S.S. ..	—	Foreign			
Bosphorus 66, T.S.S. ..	—	Foreign	—	—	—
Royal Edward, Turbine (overhaul & alterations) .	-	British	—	—	-
Royal George do.	—	Foreign	-	-	-

Ferguson Brothers, Port Glasgow.

Ozama, Dredger	—	Foreign	400		360
Heito Maru, Dredger ..	—	..	600	—	1,300
Tehwaka, Dredger	—	Colonial	350	—	400
Beam, Beverley and Walbrook, Tugs	-	British	200ea	-	1150ea
Rhyl, Dredger	-	..	1,100	-	1,650

W. Fife & Sons, Fairlie, Ayrshire.

Shaheen, Aux. Ketch (Petrol Motor)	Wood	British	83	-	-
Irex, Cutter	..	..	17	—	-
Gannet, Aux. Ketch (Paraffin Motor)	..	..	37	-	-
Sophie Elisabeth (part steel frame), Cutter	..	Foreign	49	—	—
Ariel and Cingalee, Cutters	..	British	4ea	—	—
Irene, Cutter	..	British	9	—	—
The Truant, Cutter	..	..	9	-	—

Fleming & Ferguson, Ltd., Paisley.

† Paritubu	Steel	British	—	800	800
† 2 Steam Lighters, shipped in pieces	..	Foreign	—	1,000	800
† Skeandhu	..	British	—	120	300
† 2 Harbour Service Vessels, shipped in pieces	..		1,600	—	1,400
† Nessie	..	..	—	150	200
† 2 Steam Barges, shipped in pieces	..		1,600	—	1,400
† T.C.C., No. 8	..	..	—	700	800
† 2 sets Triple Expansions, shipped in Canada ..	—	—	—	—	—

John Fullerton & Co., Paisley.

* Clydeside	Steel	British	405	—	600
* Walnut	..	..	340	-	394
† Primrose	..	..	611	-	571
† Clydenmbor	..	..	793	—	792
† Alert	..	..	195	-	687

The Greenock & Grangemouth Dockyard Co., Ltd., Greenock and Grangemouth.

Greenock Yard.

Impoco, Single Screw Str., for carrying oil in bulk	Steel	Foreign	1,683	—	1,500
Barshaw, Screw Cargo Steamer	..	British	794	—	850
Broompark, Screw Cargo ..	..	..	1,209	—	750

Grangemouth Yard.

Brandenburg, Screw Cargo Steamer	Steel	British	1,446	—	1,000
Oldenburg, Screw Cargo Steamer	..	..	1,454	—	1,000
Madgeburg, Screw Cargo Steamer	..	..	1,451		1,000
El Zarate, Twin-Screw Steamer	..	Foreign	1,150	—	800

William Hamilton & Co., Ltd., Port Glasgow.

† Saint Ronald	Steel	British	4,387	—	2,200
† Middleham Castle	..	..	4,534	--	2,800
† Jonathan Holt and Thomas Holt	..	..	1,821ea		1,100ea
† Howick Hall	..	..	4,922	—	3,000
† Saint Kilda	..	..	39,389	2,200	-
Araujo Pinho, Floating Dock		Foreign	2,000	--	—

J. & J. Hay, Ltd., Kirkintilloch, Glasgow.

* Cretan, Smack	Steel	British	2	92	100

David & William Henderson & Co., Ltd., Partick, Glasgow.

Lisboa, Twin-Screw	Steel	Foreign	7,459	—	7,550
Inventor, Screw	..	British	7,679	—	4,250
Duchess of Richmond, Paddle ..		..	384	—	990

A. & J. Inglis, Ltd., Point House.

* Wairoona, P.S.	Steel	Colonial	1,412	—	3,500
* Mountaineer, P.S.	..	British	235	—	650
† Lavolara, S.S.	..	Foreign	462	—	600
Eagle III, engined Builders.	-	British	--	--	1,600
† Arabia	—	..	--	--	550
* ———	--	-	-		90

* Compound. † Triple.

Lobnitz & Co., Ltd., Renfrew.

Name of Vessel.	Built of	Owners	G.T. Regis.	G.T. inclu. erect.	I.H.P.
N.E.R. No. 7, Suction Dredger	—	British	820	—	1,350
Benue, Stern Wheel Steamer	—	,,	42	-	100
* S.P. and S. No. 4, Hopper Barge	—	,,	188	-	-
* 2 Hopper Barges	—	,,	400	—	-
* Victoria, Bucket Dredger	-	Foreign	205	-	370
* 2 Hopper Barges	-	,,	250	-	-
* Hopper Barge	-	British	350	-	—
* Armor, Bucket Dredger	—	Foreign	462	—	750
* Crane Barge	—	,,	230	—	-
* Alphonso Fondere, Stern Wheel Steamer	—	,,	350	—	400
* Hopper Barge	-	British	155	-	—
* Six Rock-cutters	—	—	440	—	1,100

London and Glasgow Engineering and Iron Shipbuilding Co., Ltd., Glasgow.

Rattlesnake, T.B.D.	—	British Govt.	920	—	12,500

R. MacAllister & Sons, Dumbarton.

Paula II., Cutter Yacht	—	Foreign	50	—	—
Cynthia, Motor Yacht	-	British	4	—	—
Kia Ora, Motor Yacht	—	,,	17	—	—
Avon, Motor Yacht	-	,,	15	—	-
Aroha, Motor Yacht	—	,,	6	—	—

Peter McGregor & Sons, Kirkintilloch, Glasgow.

‡‡ Ardlern	Steel	British	99	—	130
‡‡ Nos. 47 and 48	,,	,,	80ea	—	450ea
No. 49	,,	Foreign	27	—	—

Mackie & Thomson, Ltd., Govan.

† Vincent, Cargo		British	985	-	670
† Pelican, Trawler		Foreign	263	-	530
† D. Manoel II., Trawler		,,	215	-	480
† Oak Apple, Drifter		British	98	-	280
* Brentham, Cargo	—	,,	828	-	720
† Baron Ruzette, Trawler	—	Foreign	216	—	480
† Geeland, Trawler	—	,,	260	-	530
† Cramond Island, Trawler	—	British	180	-	400
4 Barges, for shipment	—	—	98ea	-	—

Archd. McMillan & Son, Ltd., Dumbarton.

Crosshill	Steam	Steel	British	5,009	—	—
Strathan	,,	,,	,,	4,386	-	—
Strathardle	,,	,,	,,	4,379	—	—
Trabboch	,,	,,	,,	4,022	—	—
Thomas J. Drummond	,,	,,	Colonial	2,212	—	—

A. Munro, Ardrishaig.

m Moraig, Lugger	—	British	14	—	10

Murdoch & Murray, Port Glasgow.

John Bacon, S.S.	Steel	British	589	—	780
Rio Yaco, T.S.S	,,	Foreign	361	—	700
Republicano, T.S.S.	,,	,,	328	—	460
Alto Purus, S.S.	,,	,,	141	—	200
Rio Curuca, S.S.	,,	,,	333	—	600
Porto-Seguro, T.S.S.	,,	,,	393	—	830
Turuna, S.S.	,,	,,	115	—	330
Santa Maria, S.S.	,,	,,	195	—	330
Valparaiso, S.S.	,,	,,	429	—	700
Aquiry, S.S.	,,	,,	350	—	600
Muruzinho, S.S.	,,	,,	212	—	300

Napier & Millar, Ltd., Old Kilpatrick.

† Venture, T.S.S.	—	Colonial	1,012	—	1,400
d Eagle, P.S.	—	British	392	—	1,000
† Den of Glamis, S.S.	—	,,	5,200	—	3,000
† Kulambangra, T.S.S.	—	,,	2,006	—	1,400
† Cabral, S.S.	—	Foreign	580	—	960

John Reid & Co., Ltd., Whiteinch, Glasgow.

Norian, Steam Yacht	Steel	British	65	—	130

Ritchie, Graham & Milne, Whiteinch.

17 Cargo Barges (Sail)	—	Foreign	1,050	-	—
Steam Launch	—	,,	40	-	80
Rio Machado, T.S.S.	—	,,	580	-	900
Steam Launch	—	,,	20	-	35
,, ,,	—	,,	25	—	50

Russell & Co., Port Glasgow.

Highland Corrie, Highland Scot and Highland Glen, Shelter Deck Pass. and Cargo steamers (refrigerated)	—	British	7,343	—	-
Luceric and Orteric, Shelter Deck Pass. and Cargo Strs.	—	,,	6,526	—	—
Roseric, do.	—	,,	4,738	—	—
Drumcraig, Cargo Steamer	—	,,	4,662	-	-
Volnay ,,	—	,,	4,609	-	-
Copenhagen ,,	—	,,	4,539	—	—
Earl of Fortar ,,	—	,,	4,452	-	-
Luddesdale ,,	—	,,	4,402	—	—
Dunclutha ,,	—	,,	3,973	—	—

A. Robertson & Co., Sandbank, Argyllshire.

Tritonia, Racing Cutter	—	British	50	—	-
Decima, Racing Sloop	—	Foreign	8	—	-

A. Rodger & Co., Port Glasgow.

Nigretia, Single-deck Steamer	—	British	3,186	—	2,000
Ngatoro, Single-deck Str.	—	,,	1,138	—	1 100
Baron Renfrew, Shelter-deck Steamer	—	,,	1,605	-	1,200

† Triple. * Compound. ‡‡ Compound Surface Condensing. m Motor. d Tandem Diagonal.

Scotts' Shipbuilding and Engineering Co., Ltd., Greenock.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
H.M. Battleship Colossus	—	—	20,250dis.	—	25,000

Scott & Sons, Bowling, nr. Glasgow.

* St. Modan	Steel	British	237	-	260
† Amethyst	,,	,,	662	-	850
* Loch Etive	,,	,,	237	—	260
† Mariel	,,	,,	103	—	400
† Onyx	,,	,,	593	-	780
* Kinnaird Head	,,	,,	190	-	300
* Loch Leven	,,	,,	306	—	500
† No. 224	,,	,,	193	—	400
* No. 226	,,	,,	70	—	230

Wm. Simons & Co., Ltd., Renfrew.

Dredger	-	Foreign	2,224	—	3,540
Dredger	—	British	2,113	-	3,700
2 Dredgers	—	Colonial	350ea	—	450ea
Dredger	—	,,	748	-	1,300
Hopper Barge	—	,,	537	-	1,050

Alex. Stephen & Son, Ltd., Govan.

a Levuka	Steel	Colonial	6,129	—	
† Zeelandia	,,	Foreign	7,958	—	—
† Damara	,,	British	4,987	—	-
a Abhona	,,	,,	4,066	—	—
a Elisabethville	,,	Foreign	7,034	—	—

All engined by Messrs. A. Stephen & Son, Ltd.

Yarrow & Co., Ltd., Glasgow.

Parana and Sergipe, T.B.D. speed, 28 knots	—	Foreign	760ea	—	8,000ea
Soridderen, Torp. B.	—	,,	216	—	4,200
12 Yarrow Water Tube Boilers fitted with superheaters and Yarrow's patent feed heating device, for H.M.S. Yarmouth	—	British Admty.	—	—	22,000
Maria, Single-Screw Tug	—	Foreign	8	—	50
H.M.S. Archer and H.M.S. Attack, T.B.D.'s	—	British	—	—	16,000ea
Machinery for one Torpedo Boat Destroyer, 240 ft. long by 23 ft. 6 in. beam.	—	Foreign	—	-	10,000
1 Yarrow Water Tube Boiler	—	,,	—	-	100
Twin-Screw Motor Boats	—	,,	—	—	120ea
Triple-Screw Motor Boat	—	,,	18	—	300
Shallow Draught Launch	—	,,	22	—	70

THE FORTH, Etc.

John Cran & Co., Leith.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
m St. Helens, Ketch	Steel	British	50	—	-
m Solent	,,	,,	50	-	-
* Brevennik, Screw Tug	,,	Foreign	59	—	200
S. Ushla, Twin-Screw Tug	,,	,,	50	—	150

Hawthorns & Co., Ltd., Leith.

† Scapa, Silka and Sonja, Whalers	—	British	120ea		400ea

Mackay Bros., Alloa.

† Perdita	—	British	542	—	700

Ramage & Ferguson, Ltd., Leith.

† La Résolue, Aux. Steam Yacht	Steel	Foreign	695	—	750
g William Muir, Paddle Str. (rebuilt)	,,	British	—	—	1,100
† Kingstown, Screw Steamer	,,	,,	628	—	850
* Carnduff	,,	,,	259	—	350
† Estrellano	,,	,,	1,191	-	1,100

J. Weatherhead, Eyemouth.

Water Lily, Tug rig	—	British	—	15	—
2 small 16 ft. boats, Tug rig	-	,,	—	-	—

Installed seven Motors and Fishing Boats, a Herring Drifter suitable for motor or steam engine.

THE TAY.

The Caledon Shipbuilding and Engineering Co., Ltd., Dundee.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* Newport, Ferry Boat	Steam Steel	British	300	300	350
† Koolga	,, ,,	,,	1,110	1,110	1,200
† Royal Scott	,,	,,	1,726	1,775	6,000
* Charles Barrie	,,	,,	122	122	280

All engined by the Caledon Co.

The Dundee Shipbuilding Co., Ltd., Dundee.

6 Barges	Steel	—	574 total	—	-
* Fogota, S.S.	,,	Colonial	393	—	60
Svetor Spiridon, S.S.	,,	Foreign	945	—330ea.	engine
† Tinto	,,	British	696	—	600

* Compound. † Triple. a Quadruple. m Motor. g Compound Diagonal.

THE DEE.

The John Duthie Torry Shipbuilding Co., Torry, Aberdeen.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Driver, Steam Trawler	--	British	207	—	440
Alcatraz, Steam Trawler ..	—	Foreign	87	—	275
Heathery Brae, Steam Drifter	—	British	89	—	180
Maggie Gault, ...	-	..	90	—	260
Coulard Bank		..	85	—	250
Ord Hill ..		..	86	—	260
Charmouth, Steam Trawler		..	19	—	80
Braes-o-Buckie, St. Drifter..	—	..	84	—	200
Whinnieknowe	-	..	90	—	240
Loch Assater, Loch Lee and No. 347, Steam Trawlers	-	..	210ea	—	420ea

Alexander Hall & Co., Ltd., Aberdeen.

Devotion, Drifter	-	British	88	-	240
Celtic Pride, Cargo Steamer	—	..	137	--	855
Shilbottle, Cargo Steamer .	—	..	510	—	350
U.K., Salvage Steamer ..	—	..	114	—	250
New Comet, Trawler ..	—	..	177	--	350
Forelock, Drifter	—	..	89	--	250
Alice Dodds, Trawler ..	—	..	197	—	300
Horace Stroud, Trawler ..		..	208	-	360
Vasco da Gama, Trawler ..		..	265	-	440

Hall, Russell & Co., Ltd., Aberdeen.

Seis, Steam Trawler	—	Foreign	263	--	700
Loch Maree, St. Trawler ..	—	British	218	—	450
Charles, St. Trawler	—	Foreign	93	-	280
Strathlossie & Strathalmond St. Trawlers	—	British	191ea		400ea
Lass o' Doune and Loch Craig, St. Drifters		..	92ea		280ea
John G. Watson, St. Trawler	-	..	196		475
Intaba, Pass. and Cargo ..		..	4,832		3,000
John C. Meikle and Thomas Young, S. Trawlers ..		..	158ea	-	450ea
Strathfinella and Strathlethen, St. Trawlers		..	144ea	—	400ea

LIST OF VESSELS ENGINED IN 1910.

J. Abernethy & Co., Aberdeen.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
Alcatraz	J. Duthie S.B. Co., Aberdeen	300	180
† Maggie Gault, Coulard Bank, Ordhill and Whinnie Knowe ..	,, ..	260ea	18.ea
* Braes o' Buckie	,, ,,	220	1.0
* Sunnyside	W. & J. Gardiner, Cullen .	220	150
* Fogota	Dundee S.B. Co. .. .	350	130
† Loch Assater and Loch Lee	J. Duthie S.B. Co., Aberdeen—	420ea	180ea

Aitchison Blair & Co., Clyde Bank.

† Single Screw . .	Foreign	600	180
‡‡ ,,	.. . . . .	260	120
/ ,,	.. ..	40	20
‡‡ ,,	.. ..	80	120
‡‡Twin Screw	.. . .	540	150
‡‡Single Screw	..	300	120
‡‡ ,,	,, ...	680	140
/ ,, ...	. . .	40	120
‡‡Twin Screws	..	380ea	150ea
	Total	3,550	—

Campbell & Calderwood, Paisley.

7 sets of Screw Engines	Foreign	920	—
3 sets of Stern Wheel Engines . . .	,, ...	270	—

J. Cran & Co., Leith.

* Brevennik	John Cran & Co.	260	130
s Ushla	,, ,, ...	150	120

Denny & Co., Dumbarton.

/ H.M.S. Pincher . ..	British..	--	--
/ Destroyer Yarra .	Colonial .	—	—
Sir Trevelyan Wynne, Paddle ..	Eastern	-	-
/† Rotorua, Twin Sc. ..	Colonial . .	—	—
Sara, Paddle .	Eastern	-	-
Damukdia, Paddle .	.. .	-	-
† Chindwin, Single Sc. .	. . .	-	-
/ Angora ..	.. . . .	—	—
/ H.M.S. Staunch	British	—	--
Total indicated horse-power, 65,900.			

Dunsmuir & Jackson, Ltd., Govan.

‡ S.S. Strelett	Chas. Connell & Co., Ltd. ..	2,000	.
† S.S. Saint Ronald	Wm. Hamilton & Co., Ltd. ..	2,700	
† T.S. Saturnia	Chas. Connell & Co., Ltd. ..	6,300	—
/ S.S. Explorer	.. .. ..	4,100	—
† S.S. Broompark ..	Greenock & Grangemouth Dockyard Co., Ltd.	750	—
	Total	15,850	—

Also a number of Marine Boilers.

* Compound. † Triple. ‡‡ Compound Surface Condensing.
/ Quadruple. / Compound Non-Condensing. s Jet Condensing. / Turbine
/ Turbine Triple.

Gouldie, Gillespie & Co., Glasgow.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
* Owenaminane	Geo. Brown & Co.	400	120
* Kinnaird Head	Scott & Sons	300	125
* Ravenclov	Larne Shipbuilding Co.	140	120
* Ardlern	P. McGregor & Sons	130	100
* Shipped Abroad	.. ..	100	150

Hawthorns & Co., Ltd., Leith.

† Scapa, Silva & Souja ..	Hawthorns & Co., Ltd. .. .	400ea	180ea
* Veteran	Carnegie & Matthew .. .	190	140
* For Singapore	.. ..	150	120

One set of marine engines, 190 I.H.P.; 1 set of marine engines, 150 I.H.P., for Singapore.

John G. Kincaid & Co., Ltd., Greenock.

Copenhagen, Single-Screw Cargo Steamer	Russell & Co.	2,380	
Dunclutha, Single-Screw Cargo Steamer ..	,, ...	2,250	—
Impoco, Screw Oil-Tank Steamer ..	Greenock & Grangemouth Dockyard Co., Ltd.	1,500	—
Kulambangra, Twin-Screw Passenger and Cargo Steamer ..	Napier & Miller, Ltd.	1,400	—
Rio Machado, Twin-Screw Passenger and Cargo Steamer ..	Ritchie, Graham & Milne ..	900	—
Anna and Bore, Single-Screw Cargo Steamers	Campbeltown Shipbuilding Co.	850ea	—
Rio Yaco, Twin-Screw Passenger and Cargo Steamer	Murdoch & Murray	800	—
	Total	10,900	

W. V. V. Lidgerwood, Coatbridge.

† No. 5 and Charmouth	J. Duthie, Torry, Aberdeen ..	400ea	180ea
† Pelican	Mackie & Thomson, Ltd., Govan	530	180
† Dom Manoel II. ..	,, ,, ,,	480	180
† Vincent	,, ...	670	180
† Oak Apple	,, ,, ,,	280	180
† Baron Rulzette	,, ,, ,,	480	180
† Brentham	,, ...	720	160
† Goeland	,, ,, ..	530	180
† Cramond Island	,, ,, ,,	400	180
* Cromorna	Smith Dock Co., Ltd Middlesbro'	280	125
† Svetio Spitidon, T.S.	Dundee Shipbuilding Co., Dundee	700	180
† Marrawah	,, ,, ,,	500	180
* Castle Stuart	Rose St. Foundry, Inverness ..	250	160
* S.S. No. 44	.. Montrose Shipbuilding Co., Montrose	280	140
	Total	6,870	

McKie & Baxter, Govan, Glasgow.—The output for the year has been fifty-four sets of marine engines, totalling 8,595 I.H.P.

Miller & Macfie, Ltd., Glasgow.

† Venture, Twin-screw ..	Napier & Miller, Ltd.	1,300	180
* One Vessel, Tug ..	Smith's Dock Co., Ltd.	150	130
* ,, ,, ..	,, ,, ...	150	130
† Cabral	Napier & Miller, Ltd.	960	180
* Sao Pedro	,, ,, ...	480	130
*‡Yacht	South of England	60	140

Fishers, Ltd., Paisley.

‡‡Saint Modan	Scott & Sons, Bowling	300	135
‡‡Loch Etive	,, ...	300	135
‡‡Walnut	J. Fullerton & Co., Paisley ..	400	130
‡‡Norman	J. Reid & Co., Whiteinch	140	120
‡‡Name not known ..	Scott & Sons, Bowling	250	140
† Mariel	,, ,, ...	380	160
† Name not known ..	,, ,, ...	380	160

Menzies & Co., Ltd., Leith.

* White Daisy of Banff .	Engines supplied	175	—

Muir & Houston, Ltd., Glasgow.

* Bellavale	Mackie & Thomson, Govan ..	850	130
† Amethyst	Ailsa Shipbuilding Co., Ltd., Ayr	900	160
† John Bacon	Murdoch & Murray, Port Glasgow	750	170
† Thomas J. Drummond.	Archd. McMillan, Son, Ltd., Dumbarton	1,200	190
† C. A. Jaques	,, ,,	1,100	185
† Porto Seguro ..	Murdoch & Murray, Port Glasgow	830	180
† Onyx	Scott & Sons, Bowling	750	170
† Rio Curuca & Aquiry	Murdoch & Murray, Port Glasgow	600ea	180ea
† Valparaiso	,, ,,	950	180
	Total	8,230	

Rankine & Blackmore, Greenock.

† S.S. Earl of Forfar ..	Russell & Co.	2,500	180
† Volnay	,, ...	2,000	180
† Roseric	,, ...	2,750	180
† Luceric and Orteric ..	,, ...	4,000ea	180ea
† Highland Corrie, Highland Scot & Highland Glen	,, ...	5,000ea	210ea
	Total	30,850	

* Compound. † Triple. ‡‡ Compound Surface Condensing.

James Ritchie, Partick, Glasgow.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
‡‡Sogenadi	Wm. Chalmers & Co., Ltd.	340	130
‡‡Endcliffe	Wm. Walker, Maryport	475	130
Shipment work	Foreign owners	820	130-150

Ross & Duncan, Govan, Glasgow.—During the year Messrs. Ross and Duncan have constructed and fitted on board screw vessels on the Clyde fourteen sets of machinery aggregating 7,650 indicated horse power, and shipped abroad sixteensets aggregating 3,550 indicated horse power, making a total output for the year of thirty sets of 11,200 I.H.P. In addition to the boilers for these sets twenty-three boilers of 6,500 I.H.P. have been constructed for home and abroad, twenty sets of machinery of 6,550 I.H.P are at present in hand.

David Rowan & Co., Glasgow.

Liddesdale,	Forced D.r.S.	Russell & Co.	2,400	
Plutus	Natural ,,	Campbeltown Shipbuilding Co...	1,000	—
Clydeside	,, ,,	John Fullarton & Co.	600	
Trabboch	,, ,,	Archd. McMillan & Son, Ltd.	2,200	—
Indradeo	,, ,,	Charles Connell & Co., Ltd.	3,150	—
Canonbar	,, ,,	Ardrossan Dry Dock & Shipbuilding Co., Ltd.	700	—
Crosshill	,, ,,	Arch. McMillan & Son, Ltd.	2,700	—
Middleham Castle	Forced ,,	Wm. Hamilton & Co., Ltd.	2,550	—
Olga	Natural ,,	Robert Duncan & Co., Ltd.	1,550	-
Jonathan Holt	,,	Wm. Hamilton & Co., Ltd.	1,100	-
Den of Glamis	Forced ,,	Napier & Miller, Ltd.	1,000	
Knight Companion	Natural ,,	Charles Connell & Co., Ltd.	1,230	
Barshaw	,,	Greenock & Grangemouth Dockyard Co., Ltd.	880	
Luciston	,,	Robert Duncan & Co., Ltd.	1,730	
Thomas Holt	,,	Wm. Hamilton & Co., Ltd.	1,100	
Howick Hall	,,	,, ,,	3,000	
Drumcraig,	Forced ,,	Russell & Co.	3,000	
Maianbar	,, T.S.	Ardrossan Dry Dock and Shipbuilding Co., Ltd...	600	
Strathan,	Natural ,, S.	Arch. McMillan & Son, Ltd.	2,250	
Strathardle	,,	,, ,,	2,250	
Baron Renfrew	,,	A. Rodger & Co.	1,200	
Nereide	,,	Cantiere Navale Triestino	1,650	-
St. Kilda	,,	Wm. Hamilton & Co., Ltd.	2,200	
			—	
		Total	44,030	

Also 27 Boilers for shipment—11,400 I.H.P.

Sparer & Young, Ltd., Alloa.

o Potaro	Forrest & Co., Wivenhoe	60	-

IRISH.

The Dublin Dockyard Co., Dublin.

Name of Vessel.	Built of	Owners	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Penguin, Lightship	F. and A. Schooner	Iron and Steel		350	
† Cheslakee, Cargo and Passenger Steamer, Screw Scooner		Steel	Colonial	574	700
* Slieve Foy, Tug and Buoy Lifting Vessel, Twin-Screw		,,	British	154	600

Harland & Wolff, Ltd., Belfast.

a Edinburgh Castle	Twin-Scr.	Steel	British	15,250	15,000
a Pakeha,	Twin-Screw	,,	,,	7,911	4,950
a Gloucestershire,	Twin-Screw	,,	,,	8,124	4,820
a Themistocles,	Twin-Screw	,,	,,	11,500	5,580
†† Olympic,	4 cyl. Triple-Scr.	,,	,,	45,500	51,500
a Sachsen,	Single-Screw	,,	Foreign	8,250	3,700
a Bayern,	Single-Screw	,,	,,	8,250	3,700
a Maloja,	Twin-Screw	,,	British	13,000	12,770

The Larne Shipbuilding Co., Larne Harbour.

* Rivercloy	Smack	—	British	120	-	20
Pontoon		—		50	-	

Workman, Clark & Co., Ltd., Belfast.

Tenet	Steam	Steel	British	606	—	—
Muritai	,,	,,	,,	7,280	—	4,500
St. Albans	,,	,,	,,	4,111	—	3,500
Kansas	,,	,,	,,	6,074		3,300
Aeneas	,,	,,	,,	10,049		6,000
Ascanius	,,	,,	,,	10,049		6,000
Star of India	,,	,,	,,	7,516	-	4,500
Arankola	,,	,,	,,	4,500	—	8,500

LIST OF VESSELS ENGINED IN 1910.

MacColl & Co., Ltd., Belfast.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
† S.S. Tenet	Workman, Clark & Co., Ltd.	600	180
† S.S. Cheslakee	Dublin Dockyard Co.	700	185

o Oil. * Compound. † Triple. ‡‡ Compound Surface Condensing.
a Quadruple. †† Turbine Triple.

FRENCH.

Baheux Freres, Boulogne-Sur-Mer.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* Montesquieu, drifter	—	Boulogne	203	—	280
* Marie Rose, trawler	—	,,	96		180

Des Chantiers de L'Atlantique, St. Nazaire.

t France		Steel	Havre	23,000ab	—	45,000

The French Engineering and Shipbuilding Co., Dunkirk.

† Antonie, S.S.	—	Bayonne	2,390	..	1,100
† Homecourt, S.S.	—	,,	2,390		1,100
† Algérie, S.S.	—	Dunkirk	3,390	..	1,500
† Circe, S.S.		Algiers	4,130		1,500
Floating Crane		Dunkirk	700		—
† Bosphorus, 64, T.S.	Passenger	Constantinople	570		550

Labat & Limouzin, Bordeaux.

Caisson, of 600 tons.

Chantiers & Ateliers, Augustin Normand, Le Havre.

t Cavalier, Torpedo-boat Destroyer			Cherbourg	480ds	-	8,600

Ste. Anon. Des Chantiers et Ateliers de St. Nazaire (Penhoet), Chantiers de Normandie.

† Radioléine, steamer	Steel	Marseille	3,935	—	2,100
† Mantaro, steam packet	,,	El Callao (Peru)	4,600	—	3,500
† Pachitea do.	,,	,,	4,600	—	3,500

Janissaire. Torpedo-boat destroyer for the French Navy.

All the above were engined by the Chantiers de l'Atlantique, St. Nazaire, which belongs to this Society.

Ste. Anon. des Forges et Chantiers de la Mediterranee, Le Havre.

Les Ridens		Calais	1,130	—	700
Salamandre		Le Havre	124		240
Ville de Marseille		,,	5,150	—	
Ville de Bordeaux		,,	5,240		
Ville d'Oran		,,	5,240		
Fantassin		Toulon	453	—	8,000
Casque		Cherbourg	744		14,400
Hopper Barge		,,	140		
Newhaven		Dieppe-Newhaven	1,580		8,000

All engined by the above Society.

Ste. Anon des Forges et Chantiers de la Mediterranee, La Seyne, Toulon.

† Sant Anna	Steel	Marseille	6,000ds	6,904	8,000
* Duchesse de Guiche, cargo boat	,,	Rouen	1,582 ,,	1,040	480
* Marquise de Lubersac, do.	,,	,,	1,582 ,,	1,040	480
* Charlotte, do.	,,	,,	1,582 ,,	1,040	480

The first two vessels have been engined by the Society.

Ste. Anon. des Ateliers & Chantiers de Bretagne, Nantes.

† Trouville	Steel	Le Havre	210	40	1000
t Fourche	,,	Lorient	46	150	10,000
* Ville de Montjean		Nantes	12	70	240

LIST OF VESSELS ENGINED IN 1910.

J. & A. Niclausse, Paris.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
†*e* Waldeck-Rousseau	Arsenal de Lorient and Etablissement National d'Indret.	36,000	256
t Diderot	Chantiers de l'Atlantique	23,000	256
t Condorcet	Chantiers de La Loire and Chantiers de l'Atlantique	23,000	256
t Vergniaud	Chantiers de la Gironde and Forges and Chantiers de la Méditerranée	23,000	256
te Suffren (refitted)	Arsenal de Brest and Estabt. National d'Indret	16,000	256
te Medjedieh (refitted)	Chantiers Cramp (Philadelphia)	12,000	256
* Messudieh (refitted)	Chantiers Ansaldo	11,000	256

All fitted with Niclausse Boilers.

BELGIAN.

Aug. Hamman, Ostend.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Tyon, Cutter		Ostend	1[illegible]	—	
Marie Christine, Dandy Cutter		Blankenberyte	0		
Koning Albert,	,, ,,	Ostend	50		
Marie Edmond,	,, ,,	,,	[illegible]		
Jeanne d'Arc,	,, ,,	— Blankenberyte	0		
Génévieve,	,, ,,	Ostend	50	—	
Justine,	,, ,,	,,	[illegible]		
Pilot No. 4,	,, ,,	,,	60		

* Compound. † Triple. *t* Turbine. *te* Triple expansion.

Ste. Anon. John Cockerill, Hoboken.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
t Jan Breydel and Pieter de Coninck	Steel	Ostend	–	1,767ea	13,000ea
‡ Stern Wheeler	,,	Congo	–	160	150
* ,,	,,	,,	—	1,430	500
te John and Jacqueline	,,	Ostend	–	180ea	400ea
‡ Stern Wheeler	,,	Congo	–	30	65
m Steel Motor Boat	,,	Anvers	–	8	35
te Boat for Laying Mines	,,	,,	—	180	2 of 180
m Motor Boat	,,	Blankenberghe	–	15	65
‡ Governatore de Martino Screw Tug	,,	Somalie Italiane	-	40	130
* Vittorio Emanuele, Transport	,,	,,	–	122	120
m Fritz Herrmann	,,	Haiti	-	16	20
* Stern Wheeler	,,	Congo	-	230	250
Mariette, Barge	,,	Belgique	-	110	—
Sleipner, Barge	,,	Germany	-	110	–
2 Barges	,,	Congo	–	140ea	—

In addition 3 Lighters and 34 boats of various dimensions totalling 185 tons.

GERMAN.

Blohm & Voss, Hamburg.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Moltke, large cruiser for the German Navy.					
General Steamer	Steel	Hamburg	7,800ab	—	5,000ab
Esslingen Steamer	,,	,,	6,20ab	—	3,300ab

Henrich Brandenburg, Hamburg.

* No. 236, Steam Launch	Wood	Liverpool	7	—	18
No. 244, Barge	Steel	Hamburg	50	—	—
* Hai and Wels, Tugs	,,	,,	60ea	—	300ea

Bremer Vulcan Schiffbau und Maschinenfabrik, Vegesack.

† Edmund Hugo Stinnes Collier		Mulheim	2,713	1,021	1,700
† Clare Hugo Stinnes ,,		,,	4,984	3,099	1,700
† Nora Hugo Stinnes ,,		,,	4,985	3,099	1,700
a Carl Woermann, Freight Steamer	–	Hamburg	5,715	3,155	3,000
† Neufahrwasser, Tug		Bremen	261	—	600
† Santa Anna, Freight Str.	—	Hamburg	3,740	—	1,300
† Building Nos. 135, 136 137		Bremerhaven.			

Engines and boilers only.

Gustav Fechter, Konigsberg.

* No. 146 R.S. Venera and 182 R.S. Jaroslauria	Steel	Konrio	150ea	—	150ea
147 S.S. Braunsberg	,,	Braunsberg	100	—	100
148 S. Lotte	,,	Konigsberg	200	—	–
149 S.S.	,,	,,	10	–	18

Flensburger Schiffsbau Geselschaft, Flensburg.

Rendsburg	Steam	Steel	Hamburg	4,639	—	3,000
Elmshorn	,,	,,	,,	4,610	—	3,000
Schwalbe I & II	,,	,,	Flensburg	83ea	—	175ea
Fritz Hugo Stinnes and Annie Hugo Stinnes 6	,,	,,	Mulheim	1,488ea	—	850ea
Helene	,,	,,	Flensburg	1,046	—	630
Kalkgrund	Lightship	,,	,,	105	–	-
Wismar	Steam	,,	Wismar	2,300	—	1,500
No. 302	Barge	,,	Flensburg	2 8	-	–
Delphin	Steam	,,	,,	280	—	240
No. 305	Dock	,,	Hamburg	4,800		-
Haimon	Steam	,,	Bremen	4,900	—	2,850

J. G. Hitzler, Lauenburg (Elbe).

‡ Vessels	Steel	—	400ea		–
m 10 Motor Boats	,,	—	—	Total	227

R. Holtz, Harburg (Elbe).

Vessels, Steam	Steel	German	184	-	415
,, Motor	,,	,,	41	—	67eff.
14 ,, Motor	,,	Abroad	134	—	269
21 ,, Lighters	,,	,,	367	—	—
17 ,, Steam	,,	,,	296	—	828
1 ,, Steam	Wood	,,	2	—	10
0 ,, Lifeboats	Wood & Steel	German	—	—	—

Howaldtswerke A-G., Kiel.

† Jeannette	Steel	Rostoff Don		520	375-400
2 Pontoons	,,	Kiel		525agg.	-
* Schleswig, Dredger	,,	Rostoff Don	—	311	350
† Societe	,,	,,		520	375-400
Floating Dock	,,	Kiel			-
Floating Dock	,,	Danzig			-
Hans	,,	Kiel		58	180
Motorboat	,,	Rostoff Don			20
,,	,,	Kiel	—	—	200
‡ Elevator Barges	,,	,,	–	210ea	—

J. W. Klawitter, Danzig.

* Friedrich Wilhelm, Tug	Steel	Tilsit	—	110	230
† Icebreaker Liebe		Danzig		250	250
† Hela, Twin-Screw Steamer		,,		425	300
Nos. 351, 352, Lighters	,,	for export	—	8	—
No. 354 Houseboat	Wood	Danzig		81	
Nos. 355-359 Pontoons	Steel	Konigsberg		105	

D. W. Kremer Sohn, Elmshorn.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
1 Boat, No. 267	Wood	Elmshorn	2	—	–
6 Barges	Comp.	Hamburg	285 total		
2 Tugs	Steel	Ausland	34 ,,	—	Total 61
1 Sailing Ship	,,	Elmshorn	48	—	—
3 Lighters	,,	Ausland	138 ,,	—	—
3 Surf Boats	Wood	,,	11 ,,	—	—
1 Ferry Boat	Steel	,,	36	—	—

Henry Kock Shipbuilding Yard, Lubeck.

2 Barges	Steel	Lubeck	50ea	—	—
* Elbe and Weser	,,	Hamburg	1,028ea	—	500ea
† Larache, No. 204	,,	Oldenburg	1,950	–	1,080
Dock I.	,,	Lubeck	1,500	—	—

Fried. Krupp Aktiengesellschaft Germaniawerft, Kiel-Gaarden.

t G 192-193	Steel	Kiel	—	—	—
† Dr. Adolf Schmidt	,,	Hamburg	3,050dis	—	1,000
m U5, U8	,,	Kiel	-	—	—
t Juguy	,,	Buenos Ayres	950	–	18,000
t Catamarca	,,	,,	950	–	18,000

C. Luhring, Brake, Oldenburg.

Bau No. 99	Steel & Wood	Hammel-warden	19	-	—
Catharina Johanna and Antilope, Schooners	Steel &	Geestemünde & Hamburg	130ea	—	–
Ellfriede, Schooner	,,	Bremen	150	—	—
8 Barges	,,	,,	75ea	–	–

J. L. Meyer, Papenburg.

* Schwalbe, T.S. Steamer	Steel	Minden	—	27	50
* Logun, Tug	,,	Emden	—	50	150
m No. 247, Ferryboat	,,	Burg	—	85	20
* 3 Steam Luggers	,,	Emden and Gluckstadt	-	168ea	100ea
* 3 Tugs	,,	Harburg	—	70ea	200ea
* No. 255, Steam Launch	,,	B. Aires	–	7	20
4 Lighters	,,	Rio Grande do Sul	—	200ea	
Pomba, Stiling Lighter	—	,,	—	100	—
* 2 Steam Launches	—	,,	—	7ea	20ea

Actien Gesellschaft "Neptun," Rostock, Mecklenburg.

† Catania	Steel	Hamburg	2,996	–	1,100
Lisbeth Cords, August Cords, Carl Cords, Otto Cords	,,	Rostock	903ea	—	550ea
† Procida	,,	Hamburg	2,996	–	1,100
† Wismar	,,	,,	4,086	—	3,000
† Lipari	,,	,,	1,540	-	1,100
* Kronprinz Wilhelm	,,	Rostock	151	-	250
307, Yacht	Comp.	Schleswig	—	—	—

Nuscke & Co., Stettin.

Nos 190 and 191	Steel	Wilhelmshafen	230ea		–
* Kalbe	,,	Kiel	40		100
* No. 193	,,	Hamburg	280	—	75
Nos. 194-199	,,	Emden	1,350		—
Nos 200-205	,,	Hamburg	1,482	–	–
Nos 206-214	,,	,,	2,178	-	-
† Berthold	,,	Stettin	75	—	220

Reiherstieg Schiffswerft und Maschinenfabrik, Hamburg.

† Hamm, Schooner	Steel	Hamburg	4,598	—	3,000
a Aline Woermann, Schooner	,,	,,	3,134	—	1,450
a Getreideheber M.	,,	,,	—	—	—
a Kohlenheber III.	,,	,,	—	—	—

Rendsburg'sche Schiffs- u Maschinenbauanstalt, Rendsburg.

No 53	Steel	Hamburg	-	380	
Hansa	,,	Lissabon		130	
No. 67	Comp	Hamburg	—	390	
Nos. 68 and 69	,,	Rendsburg		55ea	
No 70	Steel	,,	-	33	
No 71	,,	Tanga		70	
No. 72	,,	Nordstrand		46	
No. 73	,,	Huseum		25	
Nos 74 and 75	,,	—	—	48ea	
Nos 76 and 77	Wood	Grand Bassum		10ea	

Rickmers Reismuhlen Rhederei & Schiffbau A. G., Bremerhaven.

† Mai Rickmers	Steel	Bremerhaven	4,102	–	1,600
† Lilly Rickmers	,,	,,	4,081	—	1,600

Gebr. Sachsenberg, Rosslau (Elbe) and Deutz.

‡‡ Goliath & Hercules, Dredgers	Steel	Kiel	520ea	—	400ea
† Gebr. Dörtelmann, St. Tug	—	Duisburg	660	—	1,100
* Kronprinzessin Cecilie, Pass. Steamer		Koln	635		700
† Berthold, Steam Tug	—	Breslau	288	—	500
†* Spül Elevator, No. 4 Dredger	—	Mannheim	320	—	1,216
† Carolus	—	Hamburg	283		320
* Brunhilde	-	Halberstadt	75		110
† Prignitz	-	Hamburg	283		320
* Ernest Rassamann	-	Mannheim	770		1,200
* Oldan		Colle	26		60
† Robert Muser	-	Mulheim a/R	660	—	1,300
Nos. 637-648	-	Hamburg	63		
2 Floating Wharves		Camp and Hiesferbruesig	60		- -
Floating Crane		Koln	188		- -
* Carl Rennert, 2 Steam Tugs		Salak	,, total		60
Spülschiff Krone, Dredger	—	Berlin	107	—	250
Floating Crane			125		
6 Dredgers		Emden	12		
Coal Barge		,,	12		-

t Turbine ‡ Hyd. Pressure * Compound. *te* Triple Expansion. *m* Motor † Triple *a* Quadruple.

* Compound † Triple *t* Turbine *m* Motor *a* Quadruple.
‡‡ Compound Surface Condensing. †* Triple Compound.

F. Schichau, Elbing.

Vessels launched, totalling gross tons 11,867; I.H.P., 97,070.

Schiffswerfte und Maschinenfabrik (Vorm. Janssen and Schmilinsky) A. G., Hamburg.

	Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
*	Tiger	Steel	Altona	38	—	220
*	Ernst Wehlen	,,	Hamburg	14	—	60
	Mosel	,,	Tanga	43	—	—
*	Milado	,,	Hamburg	53	—	240
*	Sophie	,,	,,	38	—	220
*	Fairplay IX.	,,	,,	71	—	320
*	Europa	,,	Lissabon	86	—	320

G. Seebeck Act. Ges., Bremerhaven.

*	2 Steam Trawlers	Steel	Geestemunde	—	19 ea	300ea
*	No. 298, Dredger	,,	Buenos Aires	—	77	60
*	2 Steam Luggers	,,	Geestemunde	—	145ea	100ea
	2 Gates	,,	,,	—	—	—

Stettiner Maschinenbau-Actien-Gesellschaft, "Vulcan," Stettin-Bredow.

f	2 Torpedo-boats, Nos. 184 and 185	Steel	Kiel	—	550ea	—
a	Protected Cruiser Uruguay	,,	Montevideo	—	983	8,000
†	Mecklenburg, Collier	,,	Stettin	—	2,228	1,200
f	Torpedo-boat 186	,,	Kiel	—	580	—
*	Randow, Ferry	—	Pölitz	—	100	90
‡	Vulcan, Freight Steamer	—	Stettin	—	870	400

Stettiner Oderwerke, Stettin.

†	Vineta	Steel	Stettin	682	—	450
†	Lena	,,	,,	690	—	450
†	Brandenburg	,,	,,	2,197		1,200
†	Hansa	,,	,,	1,126		750
†	B.D. 8, E.D. 8	,,	Emden	440		300
†	Steinhöft	,,	Hamburg	878	—	650
†	Aar	,,	Stettin	628		450
†	Carsten Russ	,,	Hamburg	973		650

Stocks & Kolbe, Kiel.

*	180	Steel	Sth. Brazil			2,000
*	181	,,	Ksl. Marine			120
*	153, 154	,,	Uruguay	—		50
m	150	Oak	Cuxhaven	—	—	6
	157, 160	Steel	Hamburg	—	—	—
m	161	Oak	Busum	—		6
m	162	,,	Ksl. Yacht Club	—		6
*	163	Steel	Magdeburg	—	—	2 × 35
*	164, 167	,,	Suez Canal	—		—
m	169	Oak	Kiel	—		8
m	173, 176	Steel	Suez Canal	—	—	—

H. C. Stuicken & Sohn, Hamburg.

†	Senator Michalles & Senator Mumssen	Steel	Cuxhaven	—	208ea	400ea
*	Schwalbe, Tow-boat	,,	Hamburg	—	21	50
*	Paul, Tow-boat	,,	Abroad	—	42	110
	Nos. 31 and 32, Barges	,,	,,	—	20	
*	Manoca, Steam Launch	,,	,,	—	15	40
*	Nos. 1000 and 1001, do.	Wood	Hamburg	—	5	17
*	Ida, Tow-boat	Steel	Abroad	—	15	30
†	No. 400, Fishing Steamer	,,	Cuxhaven	—	208	400
*	3 Steam Fishing Launches	Wood	Bremen	—	5ea	10ea

Joh. C. Tecklenborg Act. Ges., Geestemunde.

a	Gundrun	Steel	Bremen	4,772	—	3,200
a	Ockenfels, Birkenfels, Freientels	,,	,,	3,021ea	—	3,000ea
a	Arsterturm	,,	,,	5,300	—	2,700

J. H. N. Wichhorst, Hamburg.

*	D. Y. Hansa, II.	—	Bremen	25	—	60
*	Moenckberg	—	Hamburg	80	—	260
*	Neumayer	—	,,	80	—	260
*	Bach	—	,,	80	—	260
†	Tonderburg	—	,,	360	—	420

AUSTRIAN.

Marco M. Martinolics, Lussinpiccolo.

	Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
*	Clupea and Smaris	Steel	Trieste	—	50ea	80ea
m	Aquila	,,	,,	—	260	100

Cantiere Navale Triestino, Monfalcone.

	2 Barges for transporting horses	Steel	—	100ea	—	—
‡	S.S. Nereide	,,	Trieste	—	3,317	1,650

Austrian Lloyd's Co., Trieste.

†	Stambul	Steel	Trieste	3,820		2,200
†	4 Barges, Nos. 127 to 130	Wood	,,	480		—

Stabilimento Tecnico Triestino, Trieste.

	Erzherzog Franz Ferdinand and Radetzky, Battleships	—	—	14,000ea	—	20,000ea
	Torpedo Boats V. and VI.	—	—	110ea	—	2,300ea
	6 Lighters for carrying oil	—	—	100	—	—
	6 Lighters for carrying oil	—	—	200	—	—
	Motor Boat	—	—	—	—	32
	,,	—	—	—	—	64
	Clara Camus, Cargo Boat	—	—	4,500		1,450
	Albanien and Adelsberg, Pass. and Cargo Boats	—	—	16,25ea		1,350ea
	Sirena, Cargo Boat	—	—	4,700		1,450
	Zadar, Yacht	—	—	383	—	600
	Stadt Bregenz, Paddle Passenger Steamer	—	—	500	—	850

* Compound f Turbine. a Quadruple. † Triple.
‡ High Pressure. m Motor.

HUNGARIAN.

Nicholson & Co., Budapest.

	Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
*	Elevator Laura	Steel	Braila	—		1
	Grain barge, M.F.T.R. 751	,,	Budapest		—	—
	,, M.F.T.R. 752	,,	,,	—	—	—
*	T.S.S. Dunai & Georgji	,,	Rostow	—	69 ea	400ea
*	Elevator Elpidifor	,,	,,	—	—	250
*	Elevator, Herkules	,,	Braila	—	—	200
	Barge, F.A. 1	,,	Budapest	—	—	—

Altofner Schiffswerte der Donau Dampfschiff Gesells., Budapest.

†	Herkules and Samson	Steel	Wien	—	227ea	400ea
*	Nvil	,,	,,	—	46	180
	18 Vessels	,,	,,	—	291	
	2 Vessels	,,	Budapest	—	229	—

THE NETHERLANDS.

Antwerp Engineering Company, Hoboken.

	Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
†	(1) Tenger				800	
†	(2) Cingetorix				850	—
f	Edouard Bunge				80	
†	Marie and Nora				500ea	—

No. 1 Engined by MacColl & Pollock, Sunderland
No. 2 Engined by McKie & Baxter, Govan.
The remainder engined by North-Eastern Marine Engineering Co., Ltd.

The Arnhem Co., Arnhem.

†	Johanna, Tug	Steel	Dutch	122		175
†	Gerhard, Tug	,,	German	200	—	360
‡	Nos. 18 and 19 (Antwerp) Docks, Tugs	,,	Antwerp	125ea	—	225ea
†	No. 84, Tug	,,	Belgian	135	—	200
†	Renée, Tug	,,	,,	150	—	300
†	Concordia VIII., Cargo-boat	,,	Dutch	300	—	150
†	Adelheid	,,	German	137	—	200
†	Jeannette, Tug	,,	,,	150	—	27
†	No. 89, Tug	,,	Dutch	19	—	125
†	Rapide, Tug	,,	Belgian	65	—	80
†	Echange, Tug	,,	,,	110	—	160
†	Nos. 92 and 93	,,	German	178ea	—	280ea
*	Albertha Josepha, Tug	,,	Dutch	50	—	90
†	Spes Vera, engines only	—	Belgian		—	200
*	Landbouw LLL, engines only	—	Dutch		—	175
*	Old Suction Dredger, do.		,,		—	120
†	Betsy, do.		,,	—	—	220

G. & H. Bodewes, Hoogezand.

†	Antonina Frater and Jac. Frater Tugs		Holland			200ea
†	Everhard Frater, Tug		,,			150
†	Geertruida and Zeeland, Tugs	—	,,			175ea
*	Henderika Tug		,,			150
	Amalie, Schooner	—	Germany	125	—	
	Thea Lotto, Twin-Screw Motor		,,	150		—
	Willy, Lighter	—	Holland	60		—
	5 Sailing Vessels	—	Germany	120ea		
	5 ,,	—	,,	100ea		

Wed. C. Boele & Son, Slikkeveer bij Rotterdam.

	Halley Lighter	Steel	Rotterdam	—	2,625	
	No. 7, Lighter	,,	Rosario	—	900	—
†	Wacht am Rhein IV.		Rotterdam	—		250
†	2 Tugs	,,	Mainz	—		100ea
†	Alcigon	,,	Luih	—	—	150
†	2 Tugs	,,	Rio Grande do Sul			175ea
†	Anna		Anvers			125
*	Cor		Rotterdam			75

Bonn & Mees, Rotterdam.

†	Bandoeng	Steel	Rotterdam	3,400		2,400
†	Columbus	,,	,,	900		475
	Several Small Craft	,,	,,	350		—

Gebr. Boot Leiderdorp Yards "De Hoop" and "De Waard."

	3 Tugs		Dutch		3,150	
	27 Motor Boats	—	Various	—		
	4 Tugs					
	1 Steamer		Dutch	—	88	
	2 Yachts		,,	—	53	
	9 Sailing Luggers	—	,,		3,100	—

Friesche Scheepsbouw Maats, Ylst, near Smeek.

	No. 202, Sailing Boat	Steel	Dutch	65	—	—
	Onderneming		,,	120		
	Waterraaf, Centreboard		,,	13		
	2 Barges		,,	110ea		
	4 Sailing Boats		,,	20		
p	Anna Maria, Motor-boat		,,	40		—
	Gesiena, Schooner		,,	150	—	
	Catharina Maria		,,	130		
	4 other Vessels		,,	14		

* Compound † Triple. f Compound Non-condensing
‡ High Pressure. p Petrol.

D. Goedkoop, Jr., Kromhout Motor Works, Amsterdam.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Oil Eng. Pass. Launch	Steel	Soerabaia	—	—	70
,, Tug Boat	,,	Amsterdam	—	—	66
,, Cargo Boat	,,	,,	—	—	70
Twin Screw Oil Eng. Lifeboat largest in the world	,,	Terschelling	—	—	100
Oil Eng. Tug Boat	,,	Soerabaia	—	—	70
Twin-screw Oil Eng. Cargo Boat	,,	Gt. Brit.	—	—	100
Twin-screw High-speed Launch	,,	Bangui	—	—	80

35 other Vessels for various owners, totalling 1,000 I.H.P.

All the boats are fitted with Kromhout paraffin or Kromhout crude oil engines, and apart from these, 305 oil engines were built for vessels built abroad, indicating altogether 9,680 H.P.

De Groot & Looyen, Gorinchem.

Fortuna, Fortuna, Ludwig and St. Antoine, Canal Vessels	Iron	Germany	340ea	—	—
Elevterbah	,,	Holland	340	—	—

"Hubertina" Works, Ltd., Veerpolder, Haarlem.

* Horsens	—	Horsens	—	170	200
‡ Kleber & Passe-Partout	—	—	—	100ea	200ea
* Raffaelle	—	Parma	—	30	60
Gluckstadt, Dumb Hopper	—	Amsterdam	—	520	—
No. 01, Motor Launch	—	Batavia	—	3	—
3 Barges	—	—		370	

Gebr. Jonker, Alblasserdam.

2 Canal Barges	—	Belgian	450ea	—	—
* 2 Tugs	—	Holland	25ea	—	75ea
Motor Barge	—	,,	50	—	80
Lighter	—	,,	520	—	
Lighter	—	Belgium	660	—	
† Steam Barge	—	Holland	45	—	80
Lighter	—	Germany	1,500	—	
Lighter	—	,,	800	—	
† Tug	—	,,	80	—	180

Maatschappij voor Scheeps-en-Werktuigbouw "Fijenoord," Rotterdam.

† Van Waerwyck	Steel	Batavia	3,070	—	1,000
† Hydrograaf (hydrogr. service)	,,	The Hague	223	—	470
Noord-Hinder, lightship	,,	,,	230	—	
† Elout and Buyskes	,,	Batavia	1,773ea	—	1,100ea
† Amstelstroom	,,	Amsterdam	1,411	—	1,400

B. A. Mittendorff, Avereest, Dedemsvaart.

7 Vessels	Steel	-	780	-	—

Nederlandsche Scheepsbouw-Maatschappij, Amsterdam.

a Prinses Juliana	Steel	Amsterdam	8,035	—	5,500
† Tjitaroem	,,	Batavia	5,774	—	2,800
† Prins Hendrik	,,	Amsterdam	174	—	350
Vulcanus	,,	Batavia	1,178	—	550

Machine-Fabrik, Delftshaven, Rotterdam.

† 6 Tugs	Steel		196	-	800
* 4 Tugs	,,		110		400
* Nederlander Cargo Boat	,,	Rotterdam	100		110
* Ijssenberger Fahr. Ferry	,,	Ijssenberg	30	—	100

J. J. Pattje & Son, Waterhuizen, near Groningen.

					—
Janna, Schooner	Steel	Groningen	200dw.	-	
Otto		Emden	230		
Fortuna		Hamburg	100		
4 Lighters		-	60		

The Rotterdam Dry Dock Co., Rotterdam.

† Moordrecht	Steel	Rotterdam	900	-	950
‡ Alkaid	,,	,,	3,028		1,250
† Merak	,,	,,	3,025	-	1,250
Pemdyk	,,	,,	3,075		1,250

Scheepswerf Vorheen Jan Smit Cz., Alblasserdam, Holland.

S.S. Bipswijk		Rotterdam		1,600	900
S.S. Yssel, Steam Yacht		Zutphen	30		25
Nos. 400 & 401, Tugboats		Duisburg			2 11ea
No. 402, Hopper Barge		Shedrecht	330		

The Royal "Schelde" Shipbuilding & Engineering Co., Flushing, Holland.

Sophie H., Cargo		Rotterdam	2,930	—	1,300
† Wolf & Tret, Destroyers	—	Dutch Government	467ea	—	8,000ea

E. J. Smit & Zoon, Hoogezand.

Albatros, Schooner	Steel	Groningen	100	—	—
August, Lighter, seagoing	,,	Hamburg	200	—	
* Prinses Juliana, Cargo Str.	,,	Groningen	100	—	200
* Braunschweig, Tug	,,	Bremen		—	140
Bagger V., Dredger	,,	,,		—	
* Willy, Tug	,,	Groningen			125
Wabrudeeg, Schooner	,,	Gasselte	100	-	
m Recherche I., Motor Cutter	,,	Delfzyl	—	—	0
Smk. Cutter	,,	Winschoten	—	—	—
2 Lighters	,,	Bremen	250ea	—	—

J. & K. Smits, Scheepswerven, Kinderdijk.

Eliza, River Cargo Steamer		Venlo	130		90
* No. 626 Elevator		Venezia	260		400
* Madroño Bucket Dredger		Hredrecht	80	-	200
* Nederlander, Rive Cargo Steamer		Rotterdam	120		100
* Reederija Lek, River Passenger and Cargo Steamer		Shkeveer	300		350
* Hollandsche Bucket Dredger		Hredrecht			250
Fishguard and Goodwick, Hopper Barges		London	265ea	—	—

* Compound. † Triple. a Quadruple. m Motor.

Firma A. F. Smulders, Yard Gusto, Schiedam, nr. Rotterdam.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* 8 Bucket Dredgers	—	—	—	3,530	4,000
* 1 Suction Dredger	—	—	—	300	600
* 1 Tug Leonardo da Vinci	—	—		100	150
* Araene, Floating Workshop		—	—	40	15
* Sisifo, do., Elevator	—	—	-	100	200
m Helvetia, Yacht	—	—	—	220	45
4 Hopper Barges	—	—	—	360	—
3 Block-carrying Barges	—	—	—	330	—
‡ 2 Floating Derricks	—	—	—	720	110
‡ Grab Dredger	—	—	—	80	30

W. F. Stoel & Zoon, Alkmaar.

6 Motor Launches	Steel	Antwerp	43	—	70
2 Inspection Motor Boats	,,	,,	24	-	40
Sally, Motor Yacht	,,	—	14	—	42
Havenstoombootdienst XI., Pass. Steamer	,,	—	50	—	75
2 Motor Boats	,,	-	50	—	28
3 Cargo Barges	,,	Africa	30	—	-
3 Smaller Boats	,,	,, together 8		—	-

Van Vliet & Co., Hardinxveld.

Marrawah, Cargo Steamer	Steel	London	650	—	—
Avonthur III., do.	,,	Rotterdam	1,920	—	—
No. 82, do.	,,	London	660	—	—
Hanna, do.,	,,	Rotterdam	2200	—	—
Elfin, Tug	,,	London	30	—	—
Gerdina H., Cargo	,,	Waspik	2,343	—	-
No. 86, Cargo Steamer	,,	London	660		
Bertha, Cargo	,,	Hirschhorn van Neckar	735	-	
Merwede, Motor Yacht	,,	Hardinxveld	13		
R.S.G., 20, Cargo	,,	Rotterdam	2343		

A. Vuijk & Zonen, Capelle a.d. Yssel.

* Chassie Metsk, Cargo Boat	—	Copenhagen	1,360	—	850
Richard Grech, Tug Boat	—	London, not yet measured.			
Underwriters Tug Boat	—	London, not yet measured.			
Maud 1718, Barge	—	London	—	180	—
Firmine 2, Lighter	—	Rotterdam	—	1,810	—

3 different Lighters for Belgium, together 2,286 tons.
5 different Lighters for Germany, together 5,702 tons.
4 Crane Pontoons for the Netherlands.

Conrad Werf, Ltd., Haarlem.

† M.O.P. 209C., Hopper-Suction Dredger	—	Punta de Indio	2,500	—	2,000
† Bromo, Dredger	-	Tandjong Priok	760		600
* Sindoro, Dredger	—	Soerabaia	280	—	160
c Suriname Riviet, Lightship	-	Suriname	178		10
* Bunkermachine, "S.S.M.," Coaling Vessel	-	Rotterdam	450		240
Dump Hopper Barges		Montevideo	78		

Gebr. Wetering, Rotterdam.

* Sarah	Wood	Para		76	12

And a number of small wooden vessels.

Wilton Engineering & Slipway Co., Rotterdam.

† Prinses Juliana	Steel	Willemstad	550	500	350
† Hurttemberg	,,	Stettin	200	250	600
† Engineering and S.S. 225	,,	Rotterdam	75ea	85ea	250ea
† Donari	,,	,,	250	380	500
* Elevators 9 and 10	,,	,,	370ea	440ea	250ea
* Elevators 11 and 12	,,	,,	190ea	470ea	250ea
* Elevators 1 and 2	,,	Antwerp	190ea	470ea	250ea
m Marie	,,	Rotterdam	10	18	20
† Sub-worker	,,	London	370	480	400
m Swift	,,	Rotterdam	10	18	20

LIST OF VESSELS ENGINED IN 1910.

Alblasserdamsche Machinefabrik, Alblasserdam.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
* William Egan and Co., 27 to 32	Jonker & Stans	1,100ea	165ea
† Berrichon	(Old Ship)	270	200
12 small engines	(No Ship)	300	10
† General Osorio and Almirante Mouchez	Wed. C. Boele & Zoon	24 ea	180ea
† Unknown	Jos. Boel & Zoon	200	180
* Anna	Wed. C. Boele & Zoon	150	130
* No Ship		120	120
* Hirondelle	Gebrs. Jonker	80	120

Machinefabrik Kinderdijk, Kinderdijk.

* Madroel	T. & R. Smit's Scheepswerven	200	120
† Bavern		600	145
* Elevator		400	120
† Columbus	Bonn Mee	425	180
* Nyverheid	Gebrs. Yonker	40	110

The Netherlands Engineering Co., Amsterdam.

† Van Lins Choten	Nederl. Scheepsbouw Mj.	1600	180
† Prins Hendrik		480	160
† de Zeven Provincien Naval Yard		8,600	250
a Prinses Juliana	Nederl. Scheepsbouw Mj.	7,000	210
Cornelis	Meyer	250	
Vulcanus	Nederl. Scheepsbouw Mj.	600	

* Compound. † Triple. ‡ High Pressure.
a Quadruple. m Motor. c Single Cylinder.

The Royal "Scheldе" Shipbuilding & Engineering Co., Flushing.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
† Sophie H.	Kon. Maat. de Schelde, Flushing	1,300	160
† Wolf and Fret	,, ,, ,,	8,000ea	265ea
† Bandoing	Bonn & Mees, Rotterdam	2,500	180
† Tjitaroem	Ned. Scheepsbouw Maat. Amsterdam	2,800	180
† Zoodsboot, No. 9	Dutch Government	525	180

Lohms & Co., Rotterdam.

* Stompwigh	Boele & Pot	350	120
* Elisa	T. & K. Smit	100	120
† Helvetia VII. & VIII.	Boele & Pot	250ea	185ea
* Schsonhoven	Boele & Pot	100	120
* Ysfel	T. Smit Cz.	80	135

Gebrs. Stork & Co., Overizsel, Hengelo.

Bucket Dredger, Sindoro	Werf Conrad, Haarlem	165	120
* Dredgers Sinkep and Brussels	,, ,,	105ea 75ea	120ea
* Coaling Vessel,	,, ,,	—	—
† Name unknown	2 of 125 H.P. each	250	120
† Suction Dredger	Werf Conrad, Haarlem 4 of 500 H.P. each	2,000	165

The Wilton Engineering & Slipway Co., Rotterdam.

† Fiat Oolrintas 13	Gebr. Duyvendyk	650	200

NORWEGIAN.

Akers Mek Verksted, Kristiania.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Paris,	Sch. rigged Steel	Kristiania	—	1,034	1,000
† Gula, Sch. rigged	,, ,,	Bergen	—	265	360
† Elfsborg and Gullborg	,, ,,	Goteborg	—	591ea	450ea
† Busta, Toula and Herma	,, ,,	Leith	—	107ea	330ea
† Camocim	,, ,,	Para	—	1,398	1,000
† Vefsen	,, ,,	Norway	—	296	350
† Erris	,, ,,	Blacksod	—	107	350
† Kit	,, ,,	B.C.	—	600ab	725
† Carmen	,, ,,	Norway	—	109	350
† Neb and Klo	,, ,,	,,	—	122ea	350ea
† Ballena	,, ,,	,,	—	124	350
† Green	,, ,,	Victoria, B.C.	—	105	360
† Black and White	,, ,,	,,	—	106ea	360ea
† Brown and Blue	,, ,,	,,	-	106ea	360ea
† 303 and 304,	Schooners ,,	Sandefjord	—	ab600ea	700ea
† 305	,, ,,	Norway	—	940	ab950
† 311	,, ,,	Para	—	1,500	1,000
† 314	,, ,,	—	—	106	350
† 315	,, ,,	Kristiania	—	950	ab750
† 316, 317 and 318	,, ,,	Leith	—	106ea	350ea

All engines by Akers Mek Verksted.

A/S. Bergens Mekaniske Værksted, Bergen.

† Midnatsol	Steel	Bergen	978	976	1,100
† Skulda	,,	,,	1,105	1,271	650
† Gaula	,,	,,	1,085	1,085	650
† Hans Gude	,,	,,	1,110	1,272	650
† Pasvick	,,	Kirkenas	237	237	600
* Prompt	,,	Bergen	49	49	140
† Arcturus	,,	,,	1,310	1,310	750
† Antonico	,,	Para	457	457	400

All engines by this Company.

Christiansand Mekaniska Værksted, Christiansand.

† Tinfos, Schooner	Steel	Skien	—	186	450
† Tin, Schooner	,,	,,		160	230

Framnœs Mekaniske Værksted, Sandefjord.

† Havörn, Whaler	Steel	Sandefjord	121		300
† Don Ernisto, Whaler Tw.-scrw.	,,	,,	221	-	800

Fredrikstad Mek. Værksted, Fredrikstad.

* Dahn	Steel	Kristiania	—	40	130
* Storm	,,	Drammen	—	35	170
† Bolette and Borgila	,,	Kristiania	—	1,435ea	1,150ea
† Figaro	,,	,,	-	1,130	850
2 Hopper Barges	,,	,,	—	100ea	—

Kaldnœs Patentslip & Mek. Værksted, Tonsberg.

† H. T. Dahl	Steel	Island	130	—	400
Bok	,,	Larvik	146	—	450
* Carsten Bruun	,,	Leith	130	—	350
† Ambar and Yard No. 12	,,	Lissabou	130ea	—	350ea

Laxevaags Maskin & Jernsbibsbyggeri, Bergen.

† Breldablik	Steel	Bergen	990	1,117	650
† Modena	,,	Haugsund	990	1,148	650
† Otto Sending	,,	Bergen	—	980	600
† Ymer	,,	,,	995	1,123	675
m Concurent	,,	,,	—	26	50

All engines by this Company.

Nylands Værksted, Christiania.

† Norway, Cargo Steamer	Steel	Christiania	—	1,447	1,100
† Tanahorn, Cargo Steamer	,,	Drontheim	—	326	350
* Kue, Tugboat	,,	Christiania	—	10	35
† Snarri, Whaler	,,	Iceland	—	120	375
Rusheen, Whaler	,,	Leith	—	111	280
Bollsta, Cargo Steamer	,,	Christiania	—	1,701	900
Sarppos, Cargo Steamer	,,	,,	—	1,458	900

† Triple. * Compound. *m* Motor.

Porsgrunds Mek. Værksted, Porsgrund.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P
† Eik	Steel	Larvik	—	159	400
† Regulus	,,	Krager	—	701	500

Pusnaes Stoberi & Mek. Værksted, Arendal.

2 Barges	Steel	Skiene	—	320	
m No. 7, Ferry	Wood	Arendal	—	25	
No. 6 Barge	,,	Skien	—	125	

Trondhjems Mek. Værksted, Trondhjem.

† Gurth	Steel	Trondhjem	1,340	—	900
† Mildrid	,,	,,	1,448	—	900
† Sorö	,,	,,	492	—	800
† Kong Gudrod	,,	,,	1,091	—	900

SWEDISH.

Bergsunds Meckaniska Verstads Aktiebolag, Stockholm.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Polaris, Perseus, Regulus, and Rigel, Torpedo-boats	Steel	Swedish Navy	—	—	1,900ea
p Munchen, Motor Launch	,,	Stockhlom	—	—	30
Ernst, Dredger	,,	Limhaven	-	-	-
Barge, to load 300 tons oil in bulk, sailing	,,	Stockholm	—	—	

Eriksbergs Mek. Werksted Aktiebolag, Gothenburg.

† Viele, Passenger	Steel	Denmark	28	38	55
* Bore, Scout	,,	Sweden	ab90	ab175	230
† Tor I., Passenger	,,	,,	120	295	380
† Blidösund, Passenger	,,	,,	126	250	400

Goteborgs Nya Verkstads Aktiebolag, Gothenburg.

* 2 Revenue Tugs	-	Cronstadt	600dis ea	—	130ea
m Tranhättan, Tug	—	Goteborg	37dis	—	45
m Malli, Tug		,,	32dis	—	40
† Styrbjarn, Salvage		Narvik	160dis	—	350
† Edda, Cargo	—	Goteborg	510dis	—	380

Helsingborgs Varfs Aktiebolag, Helsingborg.

No. 33 Screw Steamer	Steel	Helsingborg	ab600	—	400

Lindholmens Werkstads Aktiebolag, Gothenburg.

† Falken, 1 mast	Steel	Halmstar	325	—	300
† Axel Johnson, 2 masts	,,	Stockholm	1,300	—	2,200

Motala Verkstads Nya Aktiebolag, Motala.

* Motala	—	Motala	190	—	125

Oskarshamns Mekaniska Verkstads Och. Skeppsdocka Aktiebolag, Oskarshamn

† Gustafsberg, 4-mast Sch.	Steel	Stockholm	—	ab1,380	700

DANISH.

H. V. Buhl & Co., Frederikshavn.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect,	I.H.P.
Nos. 126 and 127, Lighters	Oak	Nastved	45	-	-
No. 128, Cutter	Oak	Trieste	9	—	16B.H.P.
No. 129	Steel	Nykbing	16	-	16B.H.P.

Aktieselskabet Burmeister & Wain, Copenhagen.

† Japut and St. Lucia	Steel	—	2,348ea	—	1,070ea

Copenhagen Floating Dock & Shipworks, Ltd., Copenhagen.

† Odin, Schooner	—	Copenhagen	—	646	350
† Activ, Schooner	—	Korsor	—	1,310	700
m Fremad		Varde	—	30	25
2 Barges	Steel	Copenhagen	—	270	-
Floating Dock	—	,,	—	400	—

Helsingors Jenskibs-og Maskinbyggeri, Elsinore.

† Rödfaxe, S.S.	Steel	Copenhagen	1,667	—	820
† Austri and Vestri	,,	,,	442	—	300ea
† Ydun	,,	,,	645	—	400
* Kongedybet	,,	,,	42	—	130
† Yard No. 129	Unfixed		378		140

All engined by the same firm.

RUSSIAN.

Soc. Anon. Chantiers Navals Ateliers et Foundiers de Nicolaieff, Nicolaieff.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* Dredger, Dnietsrois-Kaja, No. 3	Steel	River Dniestre	—	206	160

Societe Belino Fenderich, Odessa.

* Baklan, Tug	Steel	Sebastopol	..	110dis	190
m Motor Launch	,,	,,	—	25	90B.H.
† Salvage Steamer	,,	,,	—	1,100	1,100

A. Sihle, Kolomna.

a Oil Tanker, W.K. Hagelin	Steel	—	—	—	1,600
Paddle Wheel Tugs:—					
a Maloross	,,	—	—	—	1,100
a Lesguin and Ostria	,,	—	—	—	500ea
a Kalmyk and Karamysh	,,	—	—	—	800ea
a Teplohod No. 9	,,	—	—	—	250
a 2 Inspection Boats	,,	—	—	—	90

† Triple. *m* Motor. *p* Petrol. * Compound. *a* Quadruple.

FINNISH.

Maskinfabriken "Alfa," Helsingfors, Finland.

Name of Vessel	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
6 Motor boats	Mahogany	Helsingfors	—	—	183
3 Motor boats	Pine	,,	—	—	45

ITALIAN.

Gio Ansaldo Armstrong & Co., Sestri Ponente.

Name of Vessel	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Fontiere, Liquid Fuel	Steel	Taranta	334	—	6,000
‡ Citta de Catania	,,	Palermo	—	5,097	12,000

Engined by the same firm.

Amerigo Gori, Leghorn.

Giorgio Overoli, Battleship	Steel	Greece	—	10,000dis	—
‡ Caprera, Steamer	,,	Civita Vecchia	1,805	—	223

Cantiere Navale Fortunato Menetto, Chioggia.

Constante C.	Steel	—	100 tons		—

N. fu A. Odero, Sestri Ponente.

† Citta di Messina, Fireboat	Steel	Palermo	—	3,493	1,000

Societa Esercizio Bacini, Genoa.

* Citta di Sassari	Steel	Civita Vecchia	—	2,200	3,900
† Maddalena	,,	,,	—	550	900

SPANISH.

Compania Euskalduna de Construccion y Reparacion de Buques. Bilbao.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Bizkargi-Mendi, Schooner	—	Bilbao	—	3,234	274

BALEARIC ISLANDS.

Sociedad Anglo-Espanola de Motres Gasogenes y Maquinaria General Port Mahon, Minorca.

Name of Vessel.	Built of	Owners.	G.T Regis.	G.T. inclu. erect.	I.H.P.
* One Vessel	Iron	Corunna	—	—	70
One do.	Timber	Cadiz	—	—	30
One do.	Iron	Mahon	—	—	18
Two Vessels	,,	—	—	—	150

GRECIAN.

MacDowall & Barbour, The Piræus.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* Helena, Screw Tug	Wood	Smyrna	20	—	180

PORTUGUESE.

H. Parry & Son, Lisbon.

Four steel barges to carry 450 tons cargo each, length 103 ft., beam 21 ft. 6 in., depth 9 ft. 6 in., built in Guyal, south side of Tagus, to be towed between Oporto and Leixoes.

AMERICAN.

The American Car & Foundry Co., Wilmington, Del.

Name of Vessel	Built of	Owners	G.T Regis.	G.T. inclu. erect.	I.H.P.
Car Float, No. 14	Wood		700	—	—
Sand Lighters, No. 31, 32 and			600ea	—	—
Dumping Scows, Sand 9	,,	—	1,000ea	—	—

The Bath Iron Works, Bath, Maine.

‡ Paulding, Draxton & Trippe, Torpedo-boat Destroyers		U.S. Govt	dis 742 ea		12,000ea

The Bath Marine & Construction Co., Bath, Maine.

Yo He 2 masts, Twin-screw	Wood	Bath	40	10	—
Virginia II 1 mast	,,	Friendship	15	12	—

F. S. Bowker & Son, Phippsburg, Maine.

Wm. L. Litchfield, 3-master	Wood	Boston	442	—	—

Chicago Shipbuilding Co., South Chicago.

† Pere Marquette 18, Car Ferry	Steel		—	2,000	4,000

This vessel was launched Dec. 17th, 1910, and is to be finished Jan. 15th, 1911.

Cobb, Butler & Co., Rockland, Me.

* Cumberland, Tug		Portland, Me.	100		600

Craig Shipbuilding Co., Los Angeles, Cal.

‡ General Hubbard, Schooner	—	N.Y. City	1,000	1,600	1,500
* Navajo, Screw	—	,,	1,000	1,600	1,500

† Triple. ‡ Turbine. ‖ Quadruple. * Compound.

W. Cramp & Sons, Beach and Ball, Philadelphia.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Collier, Cyclops	Steel		—	10,664	7,200
5 Barges	,,	—	—	—	—
Derrick Barge, Cyclops	,,	—	—	—	—
Three Tugs	,,	—	—	—	500ea
6 Car Floats	,,	U.S.A.	—	—	—
Brooklyn, Tug	,,	—	—	—	700
† Harrington and Mayrant, Torpedo-boat Destroyers	,,	U.S.A.	—	—	12,000ea

J. H. Dialogue, Camden, New Jersey.

* New York Central, No. 27, Tug	Steel	New York	231	—	900
† Cape Charles	,,	Philadelphia	296	—	1,000
* Ramcocas	,,	Camden	106	—	350

Dubuque Boat and Boiler Works, Dubuque, Iowa.

‡ Ste Frisco, Side Wheel Car Tug	Steel	—	—	1,104	2,000
* C.B. and 2 No. 1 Suction Dredger	Wood	—	—	—	—

Also 14 Pontoons.

J. S. Ellis & Sons, Tottenville, Staten Island.

* Clara M., Passenger Boat	—	New York	—	—	90
Charles Sofield, Oyster Boat	—	,,	—	—	80

The Fore River Shipbuilding Co., Quincy, Mass.

Aloha, Aux. Steam Yacht...	Steel	New York	—	659	400
Salmon, Holland Submarine	,,	U.S.N.	—	—	—
† Perkins, Stenett and Walke, Torpedo-boat Destroyers	,,	,,	—	—	10,500ea
Foam & Ripple, Trawlers..	,,	Boston	..	234ea	450ea
Currier, Tank Steamer	,,	New York	—	4,711	2,100

Gas Engine Power Co., Morris Heights, New York.

7 Vessels	Wood	N.Y.	263aggr.	—	3,120aggr.
Miramar Schooner	Steel	,,	135	—	200
Kugu, Tug	,,	,,	27	—	90
Jane	,,	,,	140		400
Small Launches, aggr.	Wood	,,	120	—	1,000

Great Lakes Engineering Co., Detroit, Mich.

† Ontario, Champlain and St. Clair	Steel	Duluth	5,404ea	—	1,520ea
† Wm. J. Olcott, Wm. B. Dickson and Wm. P. Palmer..	,,	,,	7,568ea	—	1,880
† Harry Yates and Theo. H. Wickwire, Jr.	,,	Buffalo	6,077ea	—	1,750ea
* Willis L. King	,,	Fairport	7,568	—	1,880

All for 1911 delivery.

Harlan & Hollingworth Corporation, Wilmington, Del.

† North Land, Steamer	Steel		3,282	4,210	4,000
Panama Dredger	,,	Panama Canal	570	570	—
Nos. 167 and 168, Car Floats	,,	N.Y. Harbour	850ea	850ea	—
Paulus, Bulk Oil Barge	,,	Philadelphia	111	111	—
Nos. 400 and 401, Car Float	,,	N.Y. Harbour	745ea	745ea	—
† Northland, Steamboat for Bay Service	,,	Washington D.C.	2,030	3,310	2,500
Benjamin B. Odell, Steamboat for River Service	,,	N.Y.	1,900	3,210	2,800
Nos. 43 and 44, Car Floats..	,,	N.Y. Harbour	852ea	852ea	—
Pure Oil Company No. 5, Bulk Oil Barge	,,	Philadelphia	2400a	2400a	130

Manitowoc Dry Dock Co., Manitowoc, Wis.

† Alabama, Pass.	Steel	U.S.A.	—	2,626	2,200
Adele, Lighter	,,	,,	—	102	—
* M. G. Hausler, Sand Sucker	,,	Chicago	—	650	400
Harvester, Lighter	,,	,,	—	107	60

T. S. Marvel Shipbuilding Co., Newburgh, New York.

* Dutchess, Ferry	Steel	Newburgh	405 nett	—	ab750
* Utica, Ferry	,,	New York	1,400gross	—	1,500
b Horicon, Side Wheel	—	Burlington	1,000 ,,	—	1,600
b Clermont, do	—	New York	1,450 ,,	—	1,800
Gifford De, Barge	Wood	Haverstraw	200ab	—	—

Maryland Steel Co., Sparrows Point, Maryland.

a Kentuckian and Georgian	Steel	New York	—	6,606ea	3,000ea
a Honolula	,,	,,	—	7,050	4,000
† Millinocket	,,	,,	—	3,330	1,800
† City of Baltimore and City of Norfolk	,,	Baltimore	—	2,200ea	2,750ea
Wahalak and Norman H. Doris	,,	,,	—	500ea	—

The Moran Co., Seattle, Washington.

† Kulshan, Steamer	Steel	Port Townsend	—	120	1,100
† Latouche	,,	,,	—	1,884	1,000
† Sioux	,,	,,	—	449	1,400

Moore & Scott Iron Works, San Francisco.

Coalinga, Tank Steamer	Steel	—	—	—	200

Newport News Shipbuilding Co., Newport News, Va.

† City of Montgomery and City of St. Louis, Freight and Passenger		Savannah Ga.	—	3,428ea	2,300ea
† J. A. Chanslor, Oil Tanker	—	San Francisco	—	4,938	2,000
‡ El Sol, El Mundo, El Oriente, and El Occidente, Freight	—	New York	—	6,008ea	5,500ea
† Ruth, Freight		,,	—	3,102	1,500
Madison, Freight	—	,,	—	3,800	3,500

Four Barges, Isthmian Canal Commission. Dump Barges addition Navy Department.

† Triple. ‡ Turbine. * Compound. ‖ High Pressure. b Beam. a Quadruple.

The New York Shipbuilding Co., Camden, New Jersey.

4 Car Floats	Steel	—	7soea	7soea	—
† 2 Colliers	,,	Boston	—	1,01soa	1,500a
Car Float, N.Y.P. & N.R.R.	,,	Philadelphia	1,288	1,288	-
† 2 Car Floats	,,	—	500ea	500ea	—
Car Float—L.V.R.R.	,,	Jersey City	1,150	1,150	-
t McCall, T.B. Destroyer	,,	U.S.A.	—	742dis	12,000
Coal Barge	,,	Stock	—	1,200	—
t Burrows, T.B. Destroyer	,,	U.S.A.	—	742dis	12,000
t Ammen, T.B. Destroyer	,,	,,	—	742dis	12,000

Perth Amboy Dry Dock Co., Perth Amboy, N.J.

Six Harbour Lighters (wood), 300 tons each. Two Brick Scows (Wood) 600 tons each. Two three-track Car Floats (wood), capacity of 17 cars each.

The Pusey & Jones Co., Wilmington, Del.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
m Alacrity, Yacht	Steel	New York	101	—	600
m Joyeuse, Yacht	,,	,,	87	-	280
† Miraflores, Tug	,,	Isthmian Canal Commission	206	—	129
† P.R.R. 35, Tug	,,	Perth, Amboy, N.J.	300	-	1,000

Skinner Shipbuilding and Dry Dock Co., Locoust Point, Baltimore, U.S.A.

* Lynnhaven, Tug	—	Norfolk, Va.	—	145	550
* Comet, Tug	—	New York	—	104	300
‡ Deluge, Fireboat	—	Baltimore	—	ab330	950
6 Derrick Lighters	—	Phila., Pa.	-	326ea	
B. & O. R.R. Co., 77P., Car Float	—	,,	—	518	—
B. & O. R.R. Co., 78P. do.	—	,,	—	518	-

Staten Island Shipbuilding Co., Port Richmond, N.Y.

3 Car Floats	—	N.Y.	—	app. 311ea	-
Topila, Tank Oil Barge	—	,,	—	200	-
Supply, Tank Oil Launch	—	,,	—	20	100
* Penna, 11 Tug	—	,,	—	178	840
* Penna, 34, Tug	—	,,	—	178	840
Fleetwood, Lighter	-	,,	—	400	400
Cargo, Oil Barge	-	,,	—	550	-
Tulsa, Oil Barge	-	,,	—	810	-

Southern Pacific Railway, Oakland, Cal.

t Seminole, Stern Wheel diver Steamer	Wood	San Francisco	—	986	1,300

Spedden Shipbuilding Co., Boston, Baltimore, Maine.

† Neptune, Sea-going Tug	—	Balto, Md.	240	-	750

Arthur D. Story, Essex, Mass.

Matthew S. Greer	Wood	Boston	110	--	
S hooner not named	,,	,,	ab130	-	
3 Schooners	,,	Glouc.	393aggr.	-	

Superior Shipbuilding Co., Superior, Wisconsin.

† Peter Reiss, Freight	Steel	Duluth	—	5,923	1,500

The Union Iron Works, San Francisco.

† Napa Valley, Single Screw	Steel	Augusta, Me.	—	1,499	2,500

CANADIAN.

G. T. Davie & Sons, Quebec.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* Lesis and Lanyon	Steel	Quebec	416ea	—	211ea
† Plesses and Columb	,,	,,	520ea	—	325ea

Joseph McGill, Shelburne, N.S.

Grand Falls	Wood	Shelburne, N.S.	—	121	—
Rotundus	,,	Windsor, N.S.	—	50	30
Dorothy M. Smart	,,	Digby, N.S.	—	94	—
Lloyd-George	,,	Lunenburg, N.S.	—	137	—
Rostand	,,	Arichat N.S	—	95	—
Schooner	—	N'fld'land	—	110	—

Polson Iron Works, Toronto.

† Ella Mary	Comp.	Toronto	—	—	125
Shuniah, Dredger	Steel	Port Arthur	—	—	1,500
* Trillium	,,	Toronto	672	—	450
c Aylmar	Comp.	Ottawa	-	—	35
Dredger No. 06	Steel	-	-	—	—
t Sternwheeler No. 97	,,	-	—	—	1,200

Smith & Rhuland, Lunenburg, N.S.

Annie L. Spindler, Schooner	Wood	Lunenburg	124	—	—
Cecil L. Beck and Marion Mosher, Schooner	,,	,,	130ea	—	—
Uda A. Saundres, Schooner	,,	,,	125	—	—
Ysabel May	,,	Halifax	123	—	—
William C. Smith	,,	Lunenburg	135	—	—
Itaska	,,	,,	124	—	—

AUSTRALIAN.

Morrison & Sinclair, Balmain, N.S. Wales.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Kirrule, Steam Ferry Steamer	—	Sydney	—	—	—
Kobiloko, Steam Island Trader	—	,,	—	-	-

m Motor. † Triple. * Compound. ‡ High Pressure.
t Turbine. *c* Single Cylinder.

LIST OF VESSELS ENGINED IN 1910.

Morts Dock and Engineering Co., Ltd., Sydney.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
† Billubera	Mort Dock Co.	1,140	180
† Kirrule	Morrison, Sinclair	680	180
May, Lighter	Morts' Dock Co.	None	

JAPANESE.

The Kaimu Sho (Local Marine Bureau), Tokyo.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* 3 Vessels	Wood	-		119aggr.	—
* Asahi-Maru, Lugger	,,	Tokyo	-	47	71
* Kwansui Maru, Ketch	,,	,,	—	47	6
* Shiguka-Maru, Nos. 1, 2, 3, 4	,,	Shinagawa		149aggr.	—
* Tazuru-Maru, Nos. 2 and 3	,,	,,	--	82aggr.	116
* Kaisei-Maru, No. 2	,,	Yokohama	—	44	—
* Shichito-Maru, Nos. 1 and 4, Schooners	,,	Tokyo		94agr.	132agr.
Sachi-Maru		Senju		27	-
Tsuun-Maru, No. 42	,,	Tokyo		76	—

Mitsu Bishi Dockyard and Engine Works, Nagasaki.

r Panama-Maru, 2 masts	Steel	Osaka	—	6,057	5,226
r Mexico-Maru, do.	,,	,,	-	6,063	5,296

Besides the above vessels, Parsons turbines for an ocean-going Destroyer were supplied to the Japanese Navy.

The Mitsu Bishi Dockyard and Engineering Works, Kobe.

* Asahi Maru, Launch	Wood	Asaka	-	50	120
Water Barge	Steel	-		102dis.	-
* Tug	,,		-	43dis.	124
† Nanto Maru, Tug and Ice-breaker	,,	Dairen		180	480
Motor Boat	Steel	Osaka	-	3	14
† Fukutomi Maru, Steam Trawler	,,	Nagasaki	—	216	475
One Boat	,,	Kobe		60	

Engined by the same Company.

Ono's Shipbuilding Yard (Ono Tekko Zosenjo), Osaka.

† Hokushin-Maru, Schooner	Steel	Otaru	-	502	380
† Uwajima-Maru 13, Sloop	,,	Uwajima		498	450

The Osaka Iron Works, Osaka.

† Regohei-Maru, Coaster	Steel	Osaka	—	757	586
o Muzuru-Maru, Ketch	,,	Kobe		86	41
* Soto-Maru, Bucket Dredger	,,	Dalny	—	600	600
* Osaka-Maru, Suction Dredger	,,	Niigata	—	594	425
* Chozan-Maru, do	,,	Dalny		180	400
* Ryuzan-Maru, Hopper Barge	,,	,,	—	600	250
* Sansan-Maru	,,	,,		600	250
† Shinko-Maru, No. 2, Whaler	,,	Nagato		130	38

The Uraga Dock Co., Uraga.

* Uraga-Maru, Sand Pump Dredger	Steel	Niigata	—	600	350
†† Jsukishima-Maru, Tugboat	,,	Kobe	—	129	340
†† Tsuruga-Maru, Bucket Dredger	,,	Tsuruga	—	256	180

CHINESE.

The New Engineering and Shipbuilding Works, Ltd., Shanghai.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Asia II	Steel	Shanghai		53	30
Lung-Wha Maru	,,	,,		49	110
Kathryn	,,	,,		42	12
Tung Tsi and Tung Hwu	,,	,,	-	270ea	300ea
Pontoon	,,	,,		100	-
10 Lighters	,,	,,		1,725	-

The Shanghai Dock and Engineering Co., Ltd.

General Weeks, Schooner	Steel	Manila	450	—	1,250
5 Cargo Boats	,,	Dalny	168ea	-	
Dairen A1, A2, A3, A4 & A5		—	650a	--	-

The Vulcan Iron Works, Ltd., Shanghai.

m Mei Che	Teak	Shanghai		15	30
m Mei Tai	,,	,,		21½	-
p No. 101	,,	,,		-	40
* Mei Foo V.	Steel	Shanghai	—	36	80
m Mei Foong, Mei Chang and Mei Sing	Teak			96ea	150ea
* Sir Marcus	Steel			25	60
Nos. 103 to 107, Pontoons	,,			132	-
No. 111, Pontoon	,,			132	-
m Joyce	Teak			—	8 B.H.P.
No. 117, Pontoon	Steel			—	-

Yangtse Engineering Works, Ltd., Hankow.

* Han-Shun, Tug	Steel	Hankow	—	—	500
20 Lighters	Wood		152ea	-	
Pontoon	Steel		22	-	
4 Pontoons	Wood		700ea		
3 Lighters	Steel		200ea		
2 Lighters	,,		100ea		

* Compound r Twin Triple † Triple. o Oil. †† Twin Compound.
m Motor. p Petrol.

HONG-KONG.

Hong-Kong and Whampoa Dock Co., Ltd.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Ferry Boat, Twin-Screws	Steel	Manila P.I.	—	210	700
Banaag	Comp.	,,	—	71	185
Murasami	Wood	Formosa	—	40	140
Wood Launch	,,	Hong-Kong	—	40	140
Thistle	Comp.	,,	—	38	140
Bankline and The Pik To	Wood	,,	—	25ea	110ea
2 Vessels	,,	,,	—	30	110
Wong Koi	,,	,,	—	—	25
Sung Sn	,,	Amoy	—	28	80
Lighter	,,	Manila	—	55	—
,, ...	Steel	,,	—	64	—
Pilot Launch	Wood	Saigon	—	32	120

Also several Motor Boats, Barges, Mooring Buoys and sundry small craft.

The Taikoo Dockyard and Engineering Co., of Hong-Kong, Ltd., Hong-Kong.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† T.S.S. Shasi	Steel	Hong-Kong	1,327	700	810
* T.S.S. Talim	,,	Manila	30	29	177
* S.S. Haphaestus	,,	Hong-Kong	87	29	421
Pontoons	,,	,,	240	240	-
2 Lighters	,,	,,	226ea	240ea	—
* S.S. Demeter	,,	,,	73	28	174
m No. 115	Wood	,,	22	15	130

INDIAN.

C. Brown & Co., Bombay.

Name of Vessel	Built of	Owners	G.T. Regis.	G.T inclu. erect.	I.H.P.
3 Sailing Barges ..	Steel	Bombay	300ea	—	—
* Tug Boats 2	,,	,,	48ea	-	154ea

STRAITS SETTLEMENTS.

Riley, Hargreaves & Co., Ltd., Singapore.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
m No. 257, Bukom III... ..	Wood	Singapore	—	—	32
m No. 258, Arthur	,,	,,	—	—	112
f No. 260, R.H. & Co. No. 7 ..	,,	—	—	—	30
m No. 261, B.P.M. 67	,,	Dutch	—	—	40
‡‡No. 262, Kukub	,,	Sinagpore	—	—	83
‡‡No. 263, N.P.V	,,	Soerabaya	—	—	120
f No. 264, A.U. Von Mechel ..	,,	Indragiri	—	—	88

The Tanjong Pagar Dock Board, Singapore.

4 Hopper Barges	Steel	Singapore	—	200ea	-
3 Lighter	,,	,,	—	80ea	—
* Launch	Wood	Penang		28	85
Crane Pontoon	Steel	Malacca		70	
Launch, hull	Wood	Kuching		10	
2 Lighters	Steel	Singapore	—	160ea	—

Engines by the Tanjong Pagar Dock Board.

LIST OF VESSELS ENGINED IN 1910.

The Tanjong Pagar Dock Board, Singapore.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
* Hawk	Singapore Slipway & Eng Co ..	105	130
* Lakitan	,, ,, ,, ..	78	135
* Wood Tug	,, ,, ,, ..	250	135
* Alice	,, ,, ,, ..	55	160
* Dock Launch	,, ,, ,, ..	55	160
* Java	T. P. D. Board	50	160
* Sunda	,, ...	350	135
* Wood Launch	Priye River Dock..	30	160

WORK COMPLETED DURING THE YEAR.

ENGLISH.

Sir W. G. Armstrong, Whitworth & Co., Ltd., Newcastle-on-Tyne.—The vessels built at Walker and Elswick Ship yards from 1852 to 1910 amount to a gross tonnage of 1,352,353 and I.H.P. 1,435,884.

S. P. Austin & Son, Ltd., Sunderland.—The stoppage of work in the shipbuilding and repairing yards owing to the labour dispute, caused the loss of much repairing work to the district, owners being compelled to have the work done largely at Continental ports, and this company felt the effect of the stoppage. The total tonnage of vessels docked by Messrs. Austin this year for painting, overhauling and repairs was 210,000 gross register, as compared with 250,000 tons last year. The work included extensive damage repairs owing to strandings and collisions, also overhauling of steamers, hulls and machinery for Lloyd's classification and converting a vessel for service in tropical waters. The pontoon is capable of taking vessels up to 7,500 tons carrying capacity, and owners can now depend upon finding the necessary accommodation for docking large vessels coming to the river Wear.

* Compound. † Triple. ‡‡ Compound Surface Condensing.
f Compound Non-Condensing. m Motor.

John Readhead & Sons, Ltd., South Shields.—In addition, a large amount of Repair work has been done at the graving dock.

J. Gordon Alison & Co., Ltd., Birkenhead.—Have not built any new tonnage during the year, but have been busily engaged in special evaporating plants, etc., for export, also tanks, pontoons, heaters, etc., for home wants, and the works generally have been busily occupied with ship and engine repairs and overhauls.

The Blyth Shipbuilding and Dry Docks Co., Ltd.—In addition to being shipbuilders, the Blyth Shipbuilding and Dry Docks Co., Ltd., are repairers of hulls and machinery, and in this department have during the year carried out some extensive repair jobs and alterations. Their five graving docks and ample facilities enable them to do work very expeditiously.

Irvine's Shipbuilding and Dry Docks Co., Ltd., West Hartlepool.—In addition to the foregoing, one vessel, the Glencliffe (No. 486), although launched in January of this year, was included in last year's tonnage, and therefore does not appear in this year's figures. During the year eighty-three vessels have been docked and repaired, and ninety-four repaired afloat, making a total of 177. Salvage:—The s.s. "Bull," sunk in the river Tees, was raised; the s.s. Hermiston floated off the rocks at Robin Hood's Bay, and a sunken hopper raised in the Hartlepool Channel, in addition to which a number of pumps, boilers and plant have been supplied for salvage jobs.

Sir Raylton Dixon & Co., Ltd., Middlesbrough-on-Tees.—In addition to building above, a large amount of repairing work has been done.

Nicholson & Sons, Glasson Docks, near Lancaster.—Have been very busy in graving dock with repairs of steamers all this year.

The Northumberland Shipbuilding Co., Ltd.—Notwithstanding the general depression during the year and the recent labour trouble, it will be seen that by comparing this year's figures with the previous returns, the Company has maintained its high position in the shipbuilding world, although the figures given do not represent the total output capacity of the Company. Included in the above are three fine deadweight carrying steamers for the Empire Transport Company, also two to carry nearly 9,000 tons built for Messrs. Thomas Wilson, Sons & Co., Ltd. There are also several of the Company's well-known type of vessel to carry about 7,500 tons each, one being for Messrs. Thomas Wilson, Sons & Co., Ltd., one for the Dalecrest Steamship Co., of Liverpool, and another for F. S. Holland, Esq., of London, and a fine cargo vessel for Messrs. Crosby, Magee & Co., of West Hartlepool. Included in the work at present in hand are other seven of the Company's well-known 7,500 tonners, one to carry about 9,000 tons, and two fine single-deck steamers, one about 7,350 and the other 7,500 tons.

Swan, Hunter & Wigham Richardson, Ltd.—In addition to tonnage launched, the dry docks department executed a number of extensive repairs to ships, engines and boilers. During seven years ending 1910, Messrs. Swan, Hunter & Wigham Richardson, Ltd., have launched 144 vessels of 573,042 gross tons; an annual average of 21 vessels of 81,863 gross tone. Maximum (in year 1906), 25 vessels of 126,921 gross tons. Among the vessels given in the launch section the Tadorna is the 21st, the Kioto the 11th, and the Carthage and Norhilda each the 6th steamship built by Messrs. Swan, Hunter & Wigham Richardson, Ltd., for their respective owners.

Walkers, Ltd. Maryborough.—Have done a considerable amount of repair work.

Isherwood System of Ship Construction.—The progress of the Isherwood system of ship construction is shown by the following. From September, 1907, to December, 1908, the number of vessels arranged to be built were six, representing about 19,747 gross register tons. During the year 1906 thirty vessels, representing about 110,055 gross register tons; during the year 1910 thirty-nine vessels, representing about 166,198 gross register tons, making a total of seventy-five vessels representing about 296,000 gross register tons. The largest vessel at present completed on the system is the Great Lakes ore carrierWilliam P. Palmer, 600 ft. by 58 ft. by 32 ft., designed to carry 11,000 tons deadweight on light draught of water, constructed by the Great Lakes Engineering Works, of Detroit, Mich., for the Pittsburgh Steamship Co., of Cleveland, Ohio. The largest sea-going vessels at present at sea are the Tjitaroem, built by Messrs. Nederlandsche Scheepsbouw Maatschappij of Amsterdam, for the Java-China Japan Line of Amsterdam; the Anglo-Patagonian, built by Messrs. Short Bros, Ltd.., of Sunderland, for Messrs. Lawther, Latta & Co., of London, and the Howick Hall, built by Messrs. W. Hamilton & Co., Ltd., of Port Glasgow, for Messrs. Chas. G. Dunn & Co., of Liverpool. Sir W. G. Armstrong, Whitworth & Co., Ltd., are now completing two specially designed vessels for the iron ore trade to carry 10,700 tons deadweight each. Work in course of construction includes two passenger and cargo vessels 500 ft. in length and Messrs. Hamilton are making preparations to lay down a steamer 500 ft. by 58 ft. The total number of builders who have already built or who are building on the system is twenty-eight. The total number of builders who have adopted the system is forty-four. Of the total number of vessels mentioned above, eight have been built or are being built in the United States, one in Canada, eight in Germany, eight in Holland, and the remainder have been built or are being built at home. In addition to the Great Lakes steamer referred to, two other large steamers have been arranged to be built on the Great Lakes by the American Shipbuilding Company, one 520 ft. long and the other 550 ft. long. It is interesting to note that of the total number of vessels built or being built, twenty-nine are for Liverpool account. As proof of the satisfaction given to shipowners who have adopted the system, it might be mentioned that one Dutch firm alone has already given orders for six vessels; one German firm for five vessels; two British firms for four vessels each; two British firms for three vessels each; and seven British firms, one American firm one Dutch firm and one Norwegian firm have given orders for two vessels each. Steamers have been built to the highest classification of Lloyd's Register, British Corporation, Bureau Veritas, Germanischer Lloyd, and Norske Veritas.

The United States Metallic Packing Co., Ltd., Soho Works, Bradford, have fitted their metallic packings to the following vessels during the year:—H.M.S.'s Exe, Waveney, King Edward VII., Garry, Princess Royal, Lion, Leven, Good Hope, Orion, Conqueror, Monarch, Thunderer, Active, Harlequin, Foyle, Australia, New Zealand, Greyhound, Stour; s.s. Szent Itsvan for Adria Co.; Inspector, Surveyor Boat and seven tugs for the Aire & Calder Navigation Co., Ltd.,; s.s.'s Rotterdam and Ocean for the American Petroleum Co.; s.s. Impoco for the Anglo-American Oil Co., Ltd.; s.s. Cameronia for the Anchor Line, Ltd.; three new steamers for the Asiatic Steam Navigation Co.; s.s. Den of Glamis and a new steamer for Chas. Barrie & Son, Dundee; s.s. Rustington for Bell, Symondson and Co.; s.s.'s Syria, Corea, Africa, Mopsa and Burma for the Bennett S.S. Co.; s.s. Gloucestershire for Bibby Bros. & Co.; s.s. Lorca for C. T.

Bowring & Co., Ltd.; s.s. Hildebrand for the Booth Steamship Co.; a new steamer for the British and Irish Steam Packet Co., Ltd.; s.s.'s Chilka, Arankola and three new steamers for the British India Steam Navigation Co.; P.S. Eagle III. for Buchanan Bros.; s.s.'s Kansa and Kioto for Bucknall S.S. Co.; s.s. Idaho for Campbell & Nicholson; a new steamer for the Canadian Pacific Railway; s.s. Medomsley for F. Carrick and Co.; R.S.V. Industry, R.S.V. Retriever and ferry steamers for the Calcutta Port Commissioners; s.s. Cameron for K. McD. Cameron & Co.; s.s. Thomas J. Drummond for the Canadian Lakes Co.; a new steamer for Cairns Noble & Co.; s.s. Amberton for R. Chapman & Son; s.s. Middleham Castle for J. Chambers & Co.; s.s. Star of India for J. P. Corry & Co.; s.s. Bandon for the Cork S.S. Co.; s.s. Lady Cory Wright and a new steamer for Wm. Cory & Sons, Ltd.; s.s.'s Tyria and Franconia for the Cunard S.S. Co.; s.s. Kursk for the East Asia S.S. Co.; s.s. Cottingham for the East Yorkshire S.S. Co. (Alex. Meek & Co.); s.s. St. Albans for the Eastern and Australian S.S. Co.; s.s. Elizabethville for Elder, Dempster & Co.; s.s.'s City of Chester, City of Bombay, Estrellano, Langton Hall, Lisbon and three new steamers for Ellerman Lines, Ltd; a new steamer for Federal Steam Navigation Co.; S.F. Sir John Baker for the Floating Bridge Co., Gosport; s.s.'s Martha Washington and Argentina for Fratelli Consulich, Trieste; s.s.'s Dewsbury, Accrington, Blackburn and Bury for the Great Central Railway Co.; s.s.'s Prince George and Prince Rupert for the Grand Trunk Railway; s.s.'s Baden, Bayern and Preussen for the Hamburg-American Line; s.s. Alice for Geo. R. Haller, Hull; s.s.'s Harperley, Harpagus, Harlesden, Harpalion, Harford, Harport and Harmattan for J. & C. Harrison, London; s.s.'s Inventor, Professor and Explorer for T. & J. Harrison, Liverpool; s.s. Purley for Houlder, Middleton & Co.; a new steamer for Houlder Bros. & Co.; s.s.'s Zealandia and Weirvona for Huddart, Parker & Co.; s.s.'s Tearaght and Alexandra for the Irish Lights Commissioners; s.s.'s Hudder, Wharfe and Don for the Lancashire & Yorkshire Railway; a new steamer for Lamport & Holt, Liverpool; s.s. Duchess of Richmond for the London, Brighton and South Coast Railway; s.s. Ymer for Lund & Co., Bergen; a new yacht for Mr. H. J. Mason; s.s.'s Clydesdale, Claymore, Sheila, and Mountaineer for MacBrayne & Co.; s.s. Hamilton for J. Marshall & Sons; s.s. Darnara for McLay & McIntyre; s.s.'s Portsmouth and Meadowfield for McNeil Hinde & Co.; s.s. Port Kembla for Milburn & Co.; s.s. Hekla for Mail and Holtby, Christiania; s.s. Waverley for North British Railway; s.s. Rotorua for the New Zealand Shipping Co., Ltd.; s.s. Burringbah for the North Coast of Auckland S.S. Co.; s.s. Orama for the Orient Steam Navigation Co.; a yacht for Wm. Philip & Son, Ltd.; T.S.S.'s Walbrook, Beam, Beverley and tender Havengore for the Port of London Authority; s.s. Holmside for G. Pyman & Co.; s.s.'s Asturias, Conway, Catalina, Caroni, Araguaya, Aragon, Amazon and Avon for the Royal Mail Steam Packet Co.; s.s.'s Spilby, Pikehool and a new steamer for Ropner & Co.; P.S. Neptune for the Southampton, Isle of Wight and South of England Mail Steam Packet Co.; s.s. Suram for Stephens, Sutton & Stephens, Newcastle; s.s. Edilio for Societa Commercial Italiane de Navigazione, Genoa; s.s.'s Bampton and Quantock for Tatem & Co., Cardiff; s.s. Boverton for Evan Thomas, Radcliffe & Co., Cardiff; s.s. Cordova, for J. Tully & Son, Sunderland; s.s. Morayshire and a new steamer for Turnbull, Martin and Co. (Shire Line), London; three new steamers for the Union Castle Steamship Co., Southampton; s.s. Cheslakee for the Union Steamship Co., Vancouver, B.C.; s.s. Elswick Hall for Wiedner, Hopkins & Co., Newcastle-on-Tyne; s.s. Kingstown for John Weatherill & Sons, Dublin; s.s.'s Olympic and Titanic for the White Star Line; s.s. Francession for Thos. Wilson & Sons & Co., Ltd., Hull.

The Schmidt Superheating Co., Ltd.—During the year the vessels installed with superheated steam on the Schmidt system are as follows:—Edmund H. Stinnes IV., Clare H. Stinnes I., Nora H. Stinnes II. for Hugo Stinnes, Muhlheim; Stompwyk for Nieuwe Rynvaart Maatschappy, Amsterdam; Portugal, Bremen, Portimao and others for Oldenburg-Portuguese Steamship Co.; Siegen and Elberfeld for Argo Steamship Co., Ltd., Bremen; Harpen XV. for Harpener Bergbau A. G. Mulheim-Ruhr.; Vistula for "Weichsel," A. G., Danzig; Ydun & Odin for Dampskibsselskab, Copenhagen; President Christie for Det Nordenfjeldske Dampsvibsselskab, Trondhjem; 2 boats for Grundmann & Groschel, Geestemunde; 1 boat for Rotterdamsche Gemeindepolizei; Tunis, Catania, Procida, Cette and Lipari for Robt. M. Sloman, Jr., Hamburg; Wera for Wostoschny-Gesellschaft, St. Petersburg; Syrjanin for Nobel Bros., St. Petersburg; Moordrecht and Sliedrecht for Phs. van Ommeren; one vessel for Motala Verkstad's Nya A.B., Motala; Naufahrwasser for Schleppschiff-Ges., Unterweser; Friedrich Wilhelm for Ad. Gerlach Nachf., Tilsit; Simson, Elbe, Wesser and one other for Ver. Bugsier & Frachtschiff Ges., Hamburg; Odin for Kohlenberg & Putz, Geestemunde; Sachsen for Hamburg-Amerika Linie, Hamburg; Luque for MacAndrew & Co., London; Senator Hollesen and one other vessel for Zerssen & Co., Rendsburg; Hugo Markus and Kaiser Wilhelm II. for Vereinigte Elbschiff-Gesellschaft A.G., Hamburg; Nias for Stoomvart Maatschappij "Nederland," Amsterdam; 1 vessel for Nordd. Lloyd, Bremen; Dampfbagger No. XII. for Thode & Ebeling, Altona; Rastede for Hochseefischerei J. Wieting, A.-G., Bremerhaven; Wurzburg for Norddeutscher Lloyd, Bremen; F. Haniel 4 for Franz Haniel & Co., Duisburg-Ruhrort; 1 vessel for Rud. Chr. Gribel, Stettin; Hercules and Samson for Erste K.K. Priv. Danube Steamship Co., Budapest; Tynsseh IV. for Gewerkschaft "Deutscher Kaiser," Bruckhausen; Patmos, Thasos, Kythnos and Enos for Deutsche Levante Linie, Hamburg; Grossfurstin Olga and Nikolaewna for Dampfschiffahrt-Ges. Kawkus & Merkur, St. Petersburg; Algier for Rob. M. Sloman, Jr., Hamburg; Merkur for Bergenske Dampfskibs Selskab, Bergen; Traneckjaer for Sydfyenske D. Selskab; Georg for Grundmann & Groschel, Geestemunde; Uranus for Kongl. Nederl. Stoomboot Maatschappij, Amsterdam; Neptunus for Kongl. Nederl. Stoomboot Maatschappij, Amsterdam; Taunus for J. Knippscheer, Duisbur -Ruhrort.

Seamless Steel Boat Co., Ltd., Wakefield, have built 244 Lifeboats and Cutters and 15 Launches, and have 110 lifeboats, etc., and six Launches on hand.

Central Marine Engine Works, West Hartlepool.—In the boiler department there have been a large number made for home and foreign account.

Richardsons, Westgarth & Co., Ltd., Hartlepool.—In addition to the work listed in the engine section a large amount of miscellaneous work has been completed including "Contraflo" condensing plants, regenerative accumulators, steel furnaces and other iron and steel works plant.

The Wallsend Slipway and Engineering Co., Ltd., Wallsend-on-Tyne.—In addition to vessels' engines new boilers were supplied to vessels representing a total horse-power of 5,115.

Cox & Co. (Engineers), Ltd.—New boilers and machinery have also been built and fitted to several other vessels besides engine and ship repairs.

J. W. Brooke & Co., Ltd., Lowestoft.—Have been awarded at the Buenos Aires International Exhibition the Grand Prize (Diploma De Gran Premio) and also the gold medal (Diploma De Medalla De Oro). A considerable number of motors of various types and nationalities were exhibited at this important exhibition, so that the awards are made in serious competition. "Brooke" motors are of a high quality in every respect, including design, workmanship and material, and have a world-wide reputation for reliability and durability.

Bull's Metal Propellers.—During the past year Messrs. Bull's Metal and Mellord Co., Ltd., Yoker, have been extremely busy, both in their foundry department and their bronze rod-rolling mill section. The Company have recently declared a dividend of six per cent., besides writing off and reserving amounts sufficient to pay about another ten per cent. They have cast a very large number of Bull's metal propellers for steamers built on the Clyde and other shipbuilding centres, including not a few heavy propellers to their own design for large steamers of well-known lines. In quite a number of cases the propellers were to replace bronze propellers of another make. One instance was that of the Allan liner, *Hesperian*, in which the Bull's propeller replaced others made of Parsons' Manganese bronze, and the owners report a speed improvement, from the change, of about half a knot, with a slightly reduced consumption. Messrs. Allan are also having propellers of Bull's metal prepared for the *Grampian*, the sister ship to the *Hesperian*. The bronze rod-rolling department, which is the only works of its kind in Scotland, has for some time been taxed to its utmost capacity, and new sets of rolls are about to be laid down, while the Company also contemplate arranging for a large extension to their works generally.

SCOTCH.

David Rowan & Co., Glasgow.—The output of machinery of this Company for 1910 is slightly over 44,000 I.H.P., which is their largest output since 1907, that being a record year for them. This does not include boilers for shipment, in which they do a large and increasing business, the output last year in this department alone being over 11,000 I.H.P. The year 1911 promises to be a busy one.

John Cran & Co., Leith.—In addition to matter listed under launches numerous overhauls have been effected throughout the year, and the North Carr Lightship reconstructed.

The Dundee Shipbuilding Co., Ltd., Dundee, have also carried out a large amount of repairs to hulls and machinery.

Hawthorns & Co., Ltd., Leith.—In addition to work listed under another section, they have also carried out a considerable number of extensive overhauls and repairs, and have constructed a number of marine and land boilers. Throughout the year work has been quiet at both their Leith and Granton establishments.

S. & H. Morton & Co., Leith.—Have not built any vessels during the past twelve months, but have built one patent main slipway capable of handling vessels of 1,600 tons displacement; two patent main slipways, each capable of handling vessels of 1,000 tons displacement; three slipways to the order of foreign owners, each capable of handling vessels of 800 tons displacement. In addition to which they have some important ship repair work in progress and general ship repairs as usual.

Miller & Macfie, Ltd., Glasgow.—In addition to new work listed elsewhere they have carried out general repairs on machinery, boilers and hulls of fully 200 vessels.

Wm. Simons & Co., Ltd., Renfrew.—In addition to the work listed under the launch section, a large quantity of dredging machinery, boilers, and sand pump plant have been sent to foreign and home ports during the past year.

DUTCH.

Amsterde Dvoogdok Mij., Amsterdam, have repaired a number of vessels during the year.

SWEDEN.

Lysekils Mek. Verkstads Aktiebolag, Lysekil, have delivered about 500 motors, of which about 60 per cent. are marine motors from 4 to 100 h.p. The deliveries of marine motors principally have been made to Scandinavian countries and to Russia, and the total number of h.p. is about 6,000. Besides these a great number of stationary motors for industrial purposes have been delivered.

AMERICAN.

Ferro Machine & Foundry Co., Cleveland, Ohio.—Ferro engines have been fitted in the following boats built in England, viz., the Handy, built and owned by A. H. Watty, Fowey; the Nenemoosha, of the hydroplane class, built by Putney Bridge Iron Works, and the Charles Peart, built by R. Wilson & Son, South Shields. Ferro engines have also been fitted in boats built by G. A. Feltham, Portsmout., as follows: Imatra, and Eileen of 8 h.p. each. Four Brothers 7½ h.p. auxiliary, Frolic 4 h.p., No. 1 17½ h.p.

The U.S. Navy Yard, Mare Island, Cal.—Repairs and alterations proceeded with on armored cruisers, gunboats, torpedo destroyers, torpedo boats, submarines and auxiliaries.

JAPAN.

The Hakadate Dock Co., Ltd., Hakadate, Japan, have executed several extensive repair works.

HONG KONG.

The Kong-Kong and Whampoa Dock Co., Ltd., Kong-Hong.—In addition to vessels built during the year 1910, listed under the launch section, the Company also completed sixteen railway cars, eight for the Kowloon Canton Railway Co. (British section) and eight for the Canton Kowloon Railway Co. (Chinese section). The cars which were fitted with all the latest appliances make up two complete trains of 1st, 2nd and 3rd-class carriages, each car being 65 ft. overall and weighing 35 tons. The Company has also built a number of boilers.

WORK ON HAND IN BRITISH YARDS.

ENGLISH.

J. T. Eltringham & Co., South Shields.—1 gas-driven Coaster (propelled by suction gas engines), 2 powerful salvage Tugs, 1 large screw Trawler

Beaching Bros., Ltd., Great Yarmouth.

6 Drifters, total 194 tons.

Crabtree & Co., Ltd., Great Yarmouth.

Four vessels building, Steam Drifers.

Forrestt & Co., Ltd., Wyvenhoe, Essex.—Steel Mooring Lighter (Admiralty); steel single screw steam Launch, 68 ft.; 3 steam Barges, 45 ft.; 1 steam Pinnace, 50 ft.; 1 single screw steam Launch, steel, 60 ft.; 2 single screw steam Launches (wood), 52½ ft.; 1 steel stern wheel Steamer, 143 ft.; 1 steel stern wheel Steamer, 128 ft.

Edward Hayes, Watling Works, Stony Stratford.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
‡‡Tug	Steel	–	18	—	70
‡‡Launch, Twin screw	,,	–	20	—	80
‡‡Tug	,,		19	—	70
m Launch	,,	–	4½	—	40

10 sets of compound surface condensing marine engines, all being built varying from 40 to 100 I.H.P. each.

James R. Piper, East Greenwich.

Approximates 80 reg. tons.

The Thames Ironworks Shipbuilding and Engineering Co., Ltd., Canning Town

H.M.S. Thunderer, Battleship	—	–	22,500	—	27,000

Camper & Nicholson, Ltd., Gosport.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect,	I.H.P.
†*Marynthea, Twin St. Yacht	Steel	British	780	—	1,500
† Adhara, Twin Motor Yacht	—	,,	40	—	100
Fantome, Aux. Motor Yacht	Wood	British	160	—	270

Lengthened 32 ft., fitted with twin motors and practically rebuilt.
*Built in conjunction with Messrs. J. I. Thornycroft, Southampton.

P. K. Harris & Son, New Quay Street, Appledore, Devon.

Building wood schooner, 90 ft.

Hartley Mead, East Cowes.

Armorel IV. Sailing Yacht	Wood	—	48		23
Admiralty Cutters	—	—	—		—

Philip & Son, Ltd., Dartmouth.

Screw Tug	Wood	–	16		50
2 Pinnaces			12ea		—
Launch			18		70
2 Pinnaces			12ea		100ea
3 Launches	,,		25ea		90ea

Geo. & Thomas Smith, Ltd., Rye

1 Trawler	Wood		50		–

Stow & Sons, Shoreham.

New 88-ton Sailing Yacht under construction building to Class 18 years A

John I. Thornycroft & Co., Ltd., Woolston, Southampton.

Six ocean-going Destroyers, Steam Yacht, Stern Wheel Vessel, Motor Lighter, ten Motor Patrol Boats.

J. Samuel White & Co., Ltd., Cowes, Isle of Wight.

	British and Foreign Gvts.	1,888ab.	—		28,095

White Bros., Itchin, Southampton.

260-ton Y.M. Aux. Motor Cruising Schooner	—	—		—	180
80-ton Y.M. Aux. Motor Cruising Ketch	—	—	—	—	45

Isaac J. Abdela & Mitchell, Ltd., Brimscombe, Stroud.—12 on slips at present.

Isaac J. Abdela & Mitchell, Ltd., Queen's Ferry, nr. Chester.—Screw Tug of about 15 tons, twin-screw river steamer of about 200 tons, and sundry smaller craft, besides repairs.

Garston Graving Dock & Shipbuilding Co,. Ltd., Garston, Liverpool.—One tug and salvage vessel, 115 ft. × 25 ft. × 14 ft. moulded

W. J. Yarwood & Sons, Northwich, Cheshire.

Dumb Barge	Steel	British	70		
Barge	,,	,,	114		
2 Hopper Barges		–	245		–
1 Steam Steamer			58		70
* One set Engines, 1 main boiler	—	–	–		20

Lytham Shipbuilding and Engineering Co., Lytham, Lancs.

* Rio Aripuana, Amazon River Passenger & Cargo Steamer	Steel	Foreign	ab207	—	ab320
Grab Towing Lighters		British	ab110ea	—	–
* Stern-Wheel Steamer	,,	,,	—	—	—
† Amazon River Passenger and Cargo Steamer	,,	Foreign	—	—	—
Grab Steel Lighters			–	–	–

H. M. Dockyard, Devonport.

Indefatigable, Signal Masts,

[illegible]	Steel	–	18,750tons	—	43,000

H.M. Docykard, Portsmouth.—Neptune and Orion, completing.

ENGINES.

Baird Bros., North Shields, are fairly well employed with repairs.

Great Central Co-operative Engineering and Ship Repairing Co., Ltd., Grimsby.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
† Cambodia, St. Trawler	Cook, Welton & Gemmell, Beverley	500	180
† [illegible]	Cochrane & Sons, Selby	500	180

†* Triple-Compound. † Triple * Compound. *m* Motor.
‡‡ Compound Surface Condensing.

C. D. Holmes & Co., Hull.—Several sets of machinery in hand and a number of orders for new boats, auxiliaries, winches, etc.

Mersey Engineering Works Co., Ltd., Liverpool.

4 32-ft. Steel Launches for Elder Dempster and Co. Ltd.	Mersey Engine Works	20	120

A. G. Mumford, Ltd., Calver Street Engineering Works, Colchester.

‡‡Steam Launches, Tugs, small Yachts, 14 sets	Various	1,800	—

The Shields Engineering and Dry Dock Co., Ltd., North Shields.

† 17 Sets		8545	—

Sisson & Co., Ltd., Gloucester.

f Mission Launch for Congo	Salter Brothers, Oxford	50	175
‡‡Burmah Launch	Not known	160	130

In hand about 850 Brake H.P. "Sisson" enclosed engines and three sets of steam machinery for main line railway motor coaches, one set of 4 crank compound surface condensing and Sisson water tube boilers, etc., 150 I.H.P., for Thames passenger launch.

The Vauxhall and West Hydraulic Engineering Co., Ltd., Luton, Beds.

Amazon Steamer	British	550	180
Stern Wheeler	,,	270	150
Fire Float	,, Twin	120	150
Tug	,,	90	120
Stern Wheeler	,,	265	140

The Schmidt Superheating Co. Ltd.,—Vessels under construction in which superheated steam on the Schmidt system will be installed are as follows:—2 vessels building by the Flensburger Shipbuilding Co., Flensburg; Thyssen V., for Gewerkschaft "Deutscher Kaiser," Bruckhausen; 1 vessel for Det Forenede Dampsk. Selskab, Copenhagen; 4 vessels for Deutsche Levante Line, Hamburg; 1 vessel for Hamburg-Amerika Line, Hamburg; 1 vessel for Van der Zypen, Coln; 3 vessels for Argo Line, Bremen; 2 vessels for Bremer Steam Line, "Atlas," m.b.H.; 2 vessels for German owners; Minneburg and Kattenthurm, for Hansa Line, Bremen; 3 other vessels for Hansa Line, Bremen; 2 vessels for Deutsche Levante Line, Hamburg; Nyland, for Argo Line, Bremen; Kong Sigurd, for Sondenfjelds Norske D. Selskab; 1 vessel for Anders Jacobsen, Christiania; 2 vessels for Matthias Stinnes, Muhlheim-Ruhr; Venus and Vesta, for Kongl. Nederl. Stoomboot Maatschappij, Amsterdam; 1 vessel building for Henry Koch, Lubeck.

SCOTCH.

Alley & Macllellan, Ltd., Polmadie.—Light draught vessels totalling 500 tons.

Fleming & Ferguson, Ltd., Paisley.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.,
4 Vessels	—	—	—	3,000	—

London and Glasgow Engineering and Iron Shipbuilding Co., Ltd., Glasgow.—H.M.S. Yarmouth and Sydney, second-class cruisers.

Peter McGregor & Sons, Kirkintilloch, Glasgow.—One Tugboat (small).

Murdoch & Murray, Port Glasgow.—Work on hand, 400 tons.

Scott & Sons, Bowling, nr. Glasgow.—Four steamers, aggregate gross tonnage, 900.

John Cran & Co., Leith.—1 large steel screw Tug, 1 steel motor Mission Launch, 1 wood steam Ferryboat, 1 steam Launch.

J. Weatherhead, Eyemouth.—A few motors to fix; makers Messrs Beardmore, Dalmuir; Alpha, Denmark, and the Gardiner.

The Caledon Shipbuilding and Engineering Co., Ltd., Dundee.

† Andorinha	Steam	Steel	British	2,400	2,400	1,700
† Bally-Cotton & Warner	,,	,,	,,	1,340ea	1,583ea	1,500ea
† Klang	,,	,,	,,	1,680	1,987	2,800
† Princess Royal	,,	,,	,,	1,440	1,567	1,450
† No. 221 S.S.	,,	,,	,,	2,050	2,639	2,800

All to be engined by the Caledon Co.

Alexander Hall & Co., Ltd., Aberdeen.

1 Steam Trawler	—	—	205	—	390
1 ,, ,,	—	—	225	—	390
1 ,, ,,	—	—	200	—	390

ENGINES.

J. Abernethy & Co., Aberdeen.—Five sets of triple engines.

Cooper & Greig, Dundee.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
* El Zarate	Greenock & Grangemouth Dockyard Co., Ltd., Grangemouth	800	140

Fishers, Ltd., Paisley.

‡‡Name not known	P. McGregor & Sons Kirkintilloch	140	120
† ,,	Scott & Sons, Bowling	380	160
† ,,	,, ,, ,,	500	160

Menzies & Co., Ltd., Leith.

* [illegible]	Engines to supply	175	—
* [illegible]	,, ,,	150	—

David Rowan & Co., Glasgow.

Set of twin-screw quad. expansion engines for Trieste, 12,000 tons; set of twin-screw quad. expansion engines for N.Z. Shipping Co., 7,000; set of single-screw quad. expansion engines for Brocklebank & Co., 4,500 tons; also several sets for Liverpool and Glasgow owners and others.

IRISH.

The Dublin Dockyard Co., Dublin.—One steel twin-screw Passenger Steamer, 1,200 tons gross, 1,500 I.H.P.

MacColl & Co., Ltd., Belfast.

* Twin-Screw Engines		1,400	185

† Triple *Compound. ‡‡ Compound Surface Condensing.
f Compound Non-Condensing.

WORK ON HAND IN FOREIGN YARDS.

FRENCH.

Baheux Freres, Boulogne-Sur-Mer.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect	I.H.P.
St. Pierre	—		75		170
L'Afrique, trawler	—		480		700

Cie des Messageries Maritimes La Ciotat.

Paul Lecat	Steel	Marseille	-	—	11,000

The French Engineering and Shipbuilding Co., Dunkirk.

Five steamers of about 11,000 tons.

Chantiers & Ateliers, Augustin Normand, Le Havre.

‡ Bouchir			--	705dis	13,000
‡ Francis Garnier				745dis	14,500
† Platon				86dis	6,000
† Coastguard			-	37dis	400

Ste. Anon. Des Chantiers et Ateliers de St. Nazaire (Penhoet), Chantiers de Normandie.

One steam steel Packet and a steel Tug, one Torpedo-boat Destroyer and sundry craft.

Ste. Anon. des Ateliers & Chantiers de Bretagne, Nantes.

‡ Fanloc	Steel	Lorient	465	550	16,000
2 Torpedo-boat Destroyers	,,	—	600ea	830ea	15,000ea

ENGINES.

St. Anon. des Forges et Chantiers de la Mediterranee la Seyne, Toulon.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
* Marquise de Lubersac, cargo-boat	Steel	480	128
* Charlotte, cargo-boat	,,	480	128
* Arthur Capel, cargo-boat	,,	480	128
* Alice, cargo-boat	,,	480	128
* Henri-Elisa, cargo-boat	,,	480	128
† Salta	,,	7,200	185
Canada	,,	8,000	185
† Hirondelle, yacht	,,	2,200	185

J. & A. Niclausse, Paris.

te Croiseur turc	Chantiers Ansaldo	12,500	242
t Courbet	Arsenal de Lorient and Chantiers de l'Atlantique	28,000	256
te Atlas	Chantiers de Normandie and Chantiers de l'Atlantique	1,800	256
* Docks for hoisting submarines	Chantiers de la Loire	400	170
* 3 Tugs for Military Ports	Arsenal de Rochefort and Mm. Decout Lacour	360	170

All to be fitted with Niclausse Boilers.

BELGIAN.

Aug. Hamman, Ostend.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
A la Grâce de Dieu, Dandy Ctr.	—	Blankenberyte	30		—
Avance, Cutter	—	Ostend	30		—

Ste. Anon. John Cockerill, Hoboken.

te Tug, 2 Screws and Sails	Steel	Congo		50	2 of 125
* Stern Wheeler	,,	,,	—	112	150
3 Barges	,,	Siberia		610ea	—

GERMAN.

Blohm & Voss, Hamburg.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Moltke, H and J., 3 large cruisers for the German Navy.					
General Steamer	Steel	Hamburg	7,800ab	—	5,000ab
Esslingen, Steamer	,,	,,	3,300ab	—	3,300ab
Two Sailers	,,	,,	3,100ea		--
One Ship	,,	Oil-engine driven.			
Cap Finisterre, Steamer	,,	Hamburg	16,500ab	--	16,000ab
Ship, Oil-engine Driven	,,	,,	8,900ab	--	

Heinrich Brandenburg, Hamburg.

2 Steam Tugs and 3 Steam Launches in hand.

Bremer Vulkan Schiffbau und Maschinenfabrik, Vegesack.

† Building Nos. 537, 538, Freight Steamers	—	Bremen	4,940ea	-	3,350ea
* Fürst Bülow, do.	—	Hamburg	7,800		3,700
† Santa Theresa	—	,,	3,740		1,300
a Emir	—	,,	7,100		3,000
t Komet, Tramp Steamer	—	Bremen	2,150		1,380
† Yard No. 544, Freight Str.	—	Hamburg	4,600	—	2,700
† ,, Nos. 545, 546, 547, 548, Freight Strs.	—	,, & Bremen	,,250ea		1,500ea
a ,, No. 549	—	Hamburg	7,350		3,000
† ,, No. 550	—	Bremen	2,285	—	1,800
a Yard Nos. 551 and 552, Pass. & Freight	—	Hamburg	5,100ea		3,200ea
a ,, No. 553	—	,,	5,700		3,000
† ,, No. 138, Freight	-	Bremerhaven	-		1,600

Gustav Fechter, Konigsberg.

* No. 150, R.S. Königin Luise	Steel	Tilsit	200		230
* No. 153 S.S.	,,	,,	80	-	20
* No. 154 S.S.	,,	Königsberg	50		150

* Compound. † Triple. *a* Quadruple.
t Turbine. *te* Triple Expansion.

Flensburger Schiffsbau Gesellschaft, Flensburg.

No. 306	Steam	Steel	Flensburg	4,900	—	2,800
,, 307 and 308	,,	,,	Mulheim	1,000ea	—	800ea
Adelaide & Sydney	,,	,,	Hamburg	5,800ea		4,000ea
No. 311	,,	,,	,,	4,400		2,900
,, 312	,,	,,	Flensburg	5,100		3,000
,, 313	,,	,,	Hamburg	4,000		3,200
,, 314	,,	,,	Flensburg	2,600		1,600
,, 315	,,	,,	Hamburg	5,850	-	4,000

J. G. Hitzler, Lauenburg (Elbe).

m 6 Motor Boats	Steel	—	—	Total	74
2 Vessels	,,		700ea		
1 Ferry Boat	,,		—		

R. Holtz, Harburg (Elbe).

Vessels, Steam	Steel	Abroad	155	—	458
,, Motor	,,	,,	8		Sell.
4 ,, Lighters	,,	,,	114		

Howaldtswerke A-G., Kiel.

Helgoland and Ersatz Hagen	Steel	—	-	—	
† Cargo Steamer	,,	Austria	—	1,425ab	720
8 Pontoons	,,	Helgoland		336aggr.	
† Passenger Boat	,,	Kiel	-	120	200
2 Pontoons	,,	,,	—	350aggr.	—
2 Dump Barges	,,	,,	—	230	—
m Dump Barge	,,	,,	—	240	100
Passenger Boat	,,	Wyk	—	50ab	80
† Cargo Steamer	,,	Hamburg	—	1,200	800

J. W. Klawitter, Danzig.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
No. 353, Cargo Steamer	Steel	Pontianak	—	1,000	670

D. W. Kremer Sohn, Elmshorn.

5 Barges	Comp.	Hamburg	80 total		
1 Lighter	Steel	Ausland	91		
* 1 Tug	,,	,,	94		80

Henry Kock Shipbuilding Yard, Lubeck.

† Lisboa and S.S. Nos. 206 and 207	Steel	Oldenburg	1,270	—	1,050
Dock II.	,,	Lubeck	1,700	—	

Fried. Krupp Aktiengesellschaft Germaniawerft, Kiel-Gaarden.

† Dr. Adolf Schmidt	Steel	Hamburg	3,050dis		1,000
t Juguy and Catamarca	,,	Buenos Aires	7,800ea		18,000ea
‡ G 162-197	,,	Kiel	—		—
Ersatz Odin	,,	,,	—		—
t Coln	,,	,,	4,550	—	20,000
River Gunboat	,,	China	150	—	500
m Mentor	,,	Kiel	78		600
m ,, (submersible)	,,	Spezia	-		—

C. Luhring, Brake, Oldenburg.

2 Schooners	Steel	Brake	320 total.		

J. L. Meyer, Papenburg.

* Lightship, No. 254	Steel	Emden	—	600	200
,, No. 261	,,	,,		170	
* No. 264, Tug	,,	Wilhelmshaven	—	50	100
* 2 Steam Luggers	,,	Emden	—	160ea	100ea
* No. 267, Steam Lugger	,,	Glückstadt	—	168	100

Actien Gesellschaft "Neptun," Rostock, Mecklenburg.

* Cette	Steel	Hamburg	1,540	—	1,100
† S.S. 310	,,	Köln Y.R.	1,100	—	2,025
† S.S. 311	,,	Hamburg	3,000	—	1,550
† S.S. 312	,,	,,	3,000	—	1,550
* S.S. 313	,,	Wismar	120		200

Nuscke & Co., Stettin.

* Nos. 216, 217 and 218	Steel	Brunsbüttelkoog	150ea	-	280ea
† No. 219	,,	,,	650	-	375
Nos. 220 and 221	,,	Emden	540ea		-

Reiherstieg Schiffswerft und Maschinenfabrik, Hamburg.

a Lulu Bohlen, Schooner	Steel	Hamburg	1,154	—	1,480
No. 433-442	,,	,,		--	—
t No. 443, Schooner	,,	,,	6,000	—	3,700

Rickmers Reismuhlen Rhederei & Schiffbau A. G., Bremerhaven.

† Aenne Rickmers and No. 160, 2 Schooners	Steel	Bremerhaven	1,000ea	-	1,000ea

Gebr. Sachsenberg, Rosslau (Elbe), and Deutz.

Strassburg	—	Hamburg	410	-	600
† Albatross	—	,,	428		600
* Pass. & Freight Steamer	—	Köln	200dis	—	300
† Deutschland	—	Sallo	71		140
* Herzog Wittekind	—	,,	127		300
* Steam Tug	-	Hamburg	42		60

F. Schichau, Elbing.

Gross tons, 59,371; I.H.P., 164,570.

Schiffswerfte und Maschinenfabrik (Vorm. Janssen and Schmilinsky) A. G., Hamburg.

No. 318	Steel	Hamburg	1,55		1

G. Seebeck Act. Ges., Bremerhaven.

* 2 Steam Trawlers	Steel	Cuxhaven	210ea		140ea
† No. 304, Cargo Steamer	,,	Bremen	—	1,050	650
* Roland, Tugboat	,,	Hamburg	—	290	600
† 2 Cargo Steamers	,,	Mulheim		1750ea	750ea

* Compound. † Triple. *a* Quadruple. *m* Motor. *t* Turbine.

Stetti er Maschinenbau-Actien-Gesellschaft, "Vulcan," Stettin-Bredow.

t	6 Torpedo-boats	Steel	Kiel	—	550ea	—
	Floating Dock, No. 313	,,	Hamburg	—	—	—
t	S 314, Freight & Pass. St.	,,	,,	—	50,000	54,000
‡	Vulcan, Freight Steamer	,,	Stettin	—	870	400
a	S. 316	—	Hamburg	—	4,600	2,500

Stettiner Oderwerke, Stettin.

3 pieces, totalling 1,865 gross tons I.H.P. 2,150.

Stocks & Kolbe, Kiel.

	155	Steel	Kiel	—	—	—
†	168	,,	Emden	—	—	450
*	170, 171, 172	,,	Hamburg	—	—	65ea
m	177	,,	Brasilien	—	—	45
	178, 179	,,	Suez Canal	—	—	—

H. C. Stulcken & Sohn, Hamburg.

*	No. 384, Tow-boat	Steel	—	—	41	170
	No. 407, Lightship	,,	Hamburg	—	327	—
	Manrovia, Motor-boat	,,	Abroad	—	9	25
*	3 Steam Launches	—	—	totalling	35	50

Joh. C. Tecklenborg Act. Ges., Geestemunde.

	S.S. 238 Arstertrum	Steel	Bremen	5,300	—	2,700
	S.S. 239 Fremantle	,,	Hamburg	7,600	—	2,700
	S.S. 240	,,	Bremen	8,900		2,700
	S.S. 241	,,	Hamburg	8,700	—	2,700
	S.S. 242	,,	Oldenburg	353	—	450
†	Yard No. S.S. 243	Steel	Hamburg	7,600		—

Total gross reg. tonnage, 32,453, and 15,750 H.P.

J. H. N. Wichhorst, Hamburg.

	Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
*	S.S. 241	Steel	Hamburg	25	—	60
*	S.S. 242	,,	,,	70	—	140
	S.S. 243, Pontoon	—	,,	60	—	—
*	S.S. 244	—	,,	90	—	260

AUSTRIAN.

Marco M. Martinolics, Lussinpiccolo.

	Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
*	157	Steel	Ponte	200	—	500

Cantiere Navale Triestino, Monfalcone.

a	T.S.S. No. 20	Steel	Trieste	—	15,000ab	11,000
†	S.S. No. 21	,,	,,	—	4,300ab	2,000
†	S.S. No. 22	,,	,,	—	400ab	800
†	S.S. No. 23	,,	,,	—	0,100ab	2,800

Austrian Lloyd's Co., Trieste.

†	Abbazia	Steel	Trieste	3,900	—	2,200
a	Wien and Helouan	,,	,,	7,120ea	—	10,000ea

Stabilimento Tecnico Triestino, Trieste.

	Zrinyi, Battleships	—	—	14,600dis.	—	20,000
	2 Battleships	—	—	20,000dis	—	25,000ea
	3 Lighters	—	—	—	—	—
	Screw Tug Boat	—	—	—	—	150
	Olympiade, Cargo Boat	—	—	1,020	—	370

HUNGARIAN.

Nicholson & Co., Budapest.

	Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
*	S.S. Mohacs	Steel	Mohacs		—	150
m	S. Motorboat	,,	Braila	—	—	200

THE NETHERLANDS.

The Arnhem Co., Arnhem.

10 Vessels, mostly Tugs, 1 500 tons displacement, and 11 engines, totalling 2 000 I.H.P.

G. & H. Bodewes, Hoogezand.

	Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
†	Tug	—	Holland	—	—	150
†	Tug	—	Germany	—	—	300
	Sailing Vessel	—	,,	120	—	—
	Sea Lighter	—	,,	650	—	

Wed. C. Boele & Son, Slikkeveer by Rotterdam.

One Lighter and one Tug.

Bonn & Mees, Rotterdam.

*	Steam Ferryboat	Steel	Rotterdam	300	—	600
†	Palenbang	,,	,,	7,000	—	3,400

Gebr Boot Liederdorp Yards "De Hoop" and "De Waard."

	2 Tugs			—	—	—
	4 Motor Boats			—	—	—
	10 Sailing Luggers		Dutch	—	—	—
	3 Lug ers, Motor	—	Belgium	—	—	—
	1 Cutt r	—	—	—	—	—

Friesche Scheepsbouw Maats., Yist, near Sneek.

3 Vessels totalling 120 gross tons register.

* Compound. *a* Quadruple. † Triple. *m* Motor *t* Turbine. ‡ High Pressure.

D. Goedkoop, Jr., Kromhout Motor Works, Amsterdam.

Twin-screw Oil Engine for

	Custom House duties	Steel	Hellevoets lius	—	—	150
	Oil Eng. Pilot Boat	,,	Soerabaia	—	—	100
	,, Hospital Vessel	,,	Amsterdam	—	—	100

4 other vessels, totalling 76 I.H.P., and 89 Kromhout oil engines of varying H.P.

De Groot & Looyen, Gorinchem.

	Hopper Barges, Nos 83 & 84	Iron	Holland	425ea	—	—

"Hubertina" Works, Ltd., Veerpolder, Haarlem.

*	2 Tugs Steel	—	—	—	141	280
	No. 64, Dumb Hopper	—	—	—	520	—
	No. 67, Motor Barge	—	—	—	325	—
	7 Barges	—	—	—	738	—

Gebr. Jonker, Alblasserdam.

2 Hopper Barges

Maatschappij voor Scheeps-en-Werktlugbouw "Fijenoord," Rotterdam.

†	Tjimanoek	Steel	Batavia	6,500	—	2,800
	Steam Tug	,,	,,	—	—	—
	Dredging Boat	,,	Rotterdam	—	—	—

B. A. Mittendorff, Avereest, Dedemsvaart.

	3 Vessel	Steel	—	385	—	—

Nederlandsche Scheepsbouw-Maatschappij, Amsterdam.

a	Koningin der Nederlanden	Steel	Amsterdam	8,400	—	5,500
	Floating Dock	,,	,,	12,000 lifting power.		

J. J. Pattje & Son, Waterhuizen, near Groningen.

One Steel Schooner and one Motor Vessel.

The Rotterdam Dry Dock Co., Rotterdam.

†	Kembangan	Steel	Amsterdam	8,000	—	4,500

Scheepswerf Vorheen Jan Smit Cz., Alblasserdam, Holland.

	Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
	1 Lighter	—	—	—	1,700	—
	1 Hopper Barge	—	Sliedrecht	—	330	—
	2 Pontoons	—	Rotterdam	—	—	—
	1 Motor Boat	—	Utrecht	—	—	—
	1 Cargo Steamer	—	Rotterdam	—	1,700	1,100
	1 Cargo Steamer	—	,,	—	2,100	1200

The Royal "Scheide" Shipbuilding & Engineering Co., Flushing, Holland.

m	Nos. 133 and 138					
m	Nos. 133 and 138, Submarines	—	Dutch Govt.	147ea	—	445ea
m	No. 142 Submarine	—	,,	350	—	2,000
†	Zwaluw and Albatros	Comp.	,,	810ea	—	800ea
†	Nos. 140 and 141 Destroyers	—	,,	467ea	—	8,000ea
†	Oranje Nassau, Mail	—	Amsterdam	3,250	—	2,600
	No. 143	—	Rotterdam	6,800	—	3,500

E. J. Smit & Zoon, Hoogezand.

Several Tub Boats, Crude Oil Motors and Superheaters for stationary and marine plants.

J. & K. Smits, Scheepswerven, Kinderdijk.

†	Beverwijk, Barge unloading Dredger	—	Beverwijk	550	—	1,100
*	No. 634, River Cargo Steamer	—	Doesburg	110	—	90
m	No. 635, do.	—	Rotterdam	100	—	90
*	No. 636, Service Steamer	—	Kiel	15	—	55
†	No. 637, Suction Hopper Dredger	—	—	520	—	400
†	No. 638, River Cargo Steamer	—	Antwerp	200	—	150

Firma A. F. Smulders, Yard Gusto, Schiedam, nr. Rotterdam.

*	No. 344, Suction Dredger	—	—	—	300	450
*	2 Floating Cranes	—	—	—	1,100ea	240ea
†*	No. 413, Suction Dredger	—	—	—	530	1300
*	2 Bucket Dredgers	—	—	—	470	350
†	No. 416, Tug	—	—	—	160	500
†	No. 419, Suction Dredger	—	—	—	1,600	2,000

W. F. Stoel & Zoon, Alkmaar.

	1 Passenger Steamer	Steel	—	65	—	100
	2 Motor vessels	,,	—	127	—	148

Van Vliet & Co., Hardinxveld.

Vessels totalling 2,000 tons building.

A. Vuijk & Zonen, Capelle a.d. Yssel.

2 Herring Luggers for the Netherlands, 1 Cargo Boat for the U.K., 1 Lighter for Germany.

Conrad Werf, Ltd., Haarlem.

*	——— Dredger	—	Zongouldak	125	—	40
	——— Barges	—	,,	50	—	—
†	Simson, Suction Dredger	—	Germany	760	—	1,000

Wilton Engineering & Slipway Co., Rotterdam.

*	Sampi and Koemai	Steel	Batavia	250ea	320ea	250ea
*	S.S. 230	,,	Rotterdam	650	900	350

ENGINES.

Alblasserdamsche Machinefabrik, Alblasserdam.

Name of Vessel.	Builders.	I.H.P. †600	Press. lbs.
‡‡Wagenveerboot	Bonn & Mees	‡140	180
* William Egan and Co., 33 to 38	Jonker & Stans	310ea	165ea
† Beverwyk VII.	J. & K. Smit	—	180
† Cornelia & Virginie (Old Ships)		190ea	180ea
Unknown	Wed. C. Boele & Zoon	260	180
12 small engines (No Ships)		360	165

Antwerp Engineering Company, Hoboken.

1 set of Triples, 1,800 I.H.P., 3 sets of Triples 500 I.H.P., 7 set of Triples 800 I.H.P., all by North-Eastern Marine Engineering Co., for vessels building by the Antwerp Engineering Co.

m Motor. * Compound. † Triple. †* Triple Compound. *a* Quadruple. ‡‡ Compound Surface Condensing

Machinefabrik Kinderdijk, Kinderdijk.

*	Number Six	T. & R. Smit's Scheepswerven	450		120
*	Hollandschdiep	,, ,, ,,	250		120
*	——	,, ,, ,,	80		135
†		,, ,, ,,	450		180

The Netherlands Engineering Co., Amsterdam.

a	Koningen der Nede lander	Nederl. Scheepsbouw Mj.	7,000		200
†	Mine Layer	Naval Yard	800		220
†	,, ,,	,,	800		220

The Royal "Schelde" Shipbuilding & Engineering Co., Flushing.

†	Zwaluw & Albatross	Kon. Maat. de Schelde, Flushing	800ea		180ea
†	Nos. 140 and 141	,, ,,	8,000ea		265ea
†	Oranje Nassau	,, ,,	2,600		180
†	No. 143	,, ,,	3,500		200
†	Palembang	Bonn & Mees, Rotterdam	3,800		200

Lohms & Co., Rotterdam.

5 engines, I.H.P. 800, and 7 boilers.

¡Gebrs. Stork & Co., Overvzsel, Hengelo.

Engines for a Suction Dredger and

† 2 engines of 500 H.P. each	1,000		—
† 1 engine of 200 H.P.	200		—

NORWEGIAN.

Christiansand Mekaniska Værksted, Christiansand.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† No. 138	Steel	Skien	—	160	230

Framnœs Mekaniske Værksted, Sandefjord.

Name of Vessel	Built of	Owners.	G.T. Regis.	G.T inclu. erect.	I H.P.
† Whaler	Steel	Sandefjord	ab186	—	500
† 2 Whalers	,,	,,	140ea		320ea

Steel Floating Dock of 5,000 tons lifting capacity.

Fredrikstad Mek. Værksted, Fredrikstad.

† No. 140	Steel	Tonsberg	—	1,200	1,070

Laxevags Maskin & Jernsbibsbyggeri, Bergen.

† 2 Steamers	Steel	Bergen	—	1,125ea	650ea
† No. 103	,,	,,	—	980	650
† No. 104	,,	Stokmarknes	—	1,040	450

To be engined by the Company.

Nylands Værksted, Christiania.

† 2 Cargo Steamers	Steel	Nijafjord	—	ab1,540ea	1,500ea
† No. 212, Whaler	,,	Iceland	—	135	425
† No. 213	,,	Christiania	—	1,700	900

Porsgrunds Mek. Værksted, Porsgrund.

† Passenger Steamer	Steel	Skien	—	ab320	450
* Tugboat	,,	Drammen	—	ab23	100
† Whaleboat	,,	Larvik	—	165	450

Pusnaes Stoberi & Mek. Verksted, Arendal.

2 Hopper Barges	Steel	Skien	—	60ea	—
1 Barge	,,	,,	—	200	—

Trondhjems Mek. Værksted, Trondhjem.

† Nos. 144 and 146	Steel	Trondhjem	1100ea		800ea
† No. 145	,,	,,	1,400	—	900
* No. 147	,,	,,	75	—	200
† No. 148	,,	,,	1,100	—	600

SWEDISH.

Bergsunds Meckaniska Verstads Aktiebolag, Stockholm.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
1 Vessel	Steel	Russia	800ab	—	650

Eriksbergs Mek. Werksted Aktiebolag, Gothenburg.

* No. 154, Tug	Steel	—	—	—	100

Goteborgs Nya Verkstads Aktiebolag, Gothenburg.

t	Hugin Destroyer	—	—	350dis	—	8,000
m	Abisko, Passenger	—	—	—	—	30

Lindholmens Werkstads Aktiebolag, Gothenburg.

No. 407. To be launched in 1911.

DANISH.

H. V. Buhl & Co., Frederikshavn.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
No. 125, Trawler	Steel	Natal	150	—	90B.H.P.
Nos. 130, 131 and 132	Oak	Trieste	90ea	—	ea16B.H.P.

Aktieselskabet Burmeister & Wain, Copenhagen.

	Two Torpedo Vessels	Steel	Copenhagen	—	—	4,000ea
o	No. 277	,,	—	1,025	—	700
†	Nos. 278 and 279	,,	Norway	1,720ea	—	1,400ea
†	Nos. 280 and 281	,,	Denmark	1,550ea	—	1,050ea

Copenhagen Floating Dock & Shipworks, Ltd., Copenhagen.

Two vessels, Schooners		Russian	—	ab1,350ea	750

ENGINES.

Aktieselskabet Burmeister & Wain, Overgade, Copenhagen

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
o No. 276	—	3,000	—

† Triple. *Compound. t Turbine. m Motor o Oil. a Quadruple.

RUSSIAN

Soc. Anon. Chantiers Navals Ateliers et Foundiers de Nicolaieff, Nicolaieff.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
No. 85 Submarine	Steel	Particulars cannot be published.			
m No. 88, Revenue Cruiser	,,	Black Sea	—	600	1,100
* No. 89, Bucket Dredger	,,	Archangel	—	940	400
* No. 90, Paddle Steamer	,,	River Dniepre	—	110	250

Societe Belino Fenderich, Odessa.

m	Motor Launch	Steel	—	—	12dis	24
*	Launches	,,	—		66dis	75

A. Sihle, Kolomna.

o	2 Oil Tankers	Steel	—	—	—	1,300ea
o	River Paddle Wheel Pass. Ship	,,	—	—	—	1,000
o	River Screw Pass. Ship	,,	—	—	—	1,500
o	3 Paddle Wheel Tugs	,,	—	—	—	600
o	4 Dredgers	,,	—	—	—	—

FINNISH.

Maskinfabriken "Alfa" Helsingfors, Finland.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Alfa IV., Motorboat	Mahogany	Helsingfors	—	—	20
8 Motor boats	,,	,,	—	—	120

ITALIAN.

Gio. Ansaldo Armstrong & Co., Sestri Ponente.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Protect. Cruiser	Steel	Turkey	2,900		12,500
† Eridano Cistern	,,	,,	571		1,100
† Citano Tugboat	,,	,,	588		1,850
t Guilio Cesare battleship	,,	,,	11,000		24,000
t Several Torpedo boats	—	—	—		—

Engined by the same firm.

Amerigo Gori, Leghorn.

Maria, Schooner	Wood	Viareggio	—	182	—
Olga, Schooner	,,	,,	—	128	—

Cantiere Navale Fortunato Menetto, Chioggia.

Steel Schooner of 320 tons burden, with an auxiliary petroleum 40-H.P. motor and a motor of 8-H.P. will be set up to work the winches.

Cantiere Navale di Muggiano, Spezia.

1 Cargo Boat, about 5,500 gross tons register.

Officine & Cantieri Napoletani C. & T. T., Pattison, Naples.—t 6 Destroyers and †12 Torpedo Boats and machinery for Royal Italian Navy.

Societa Esercizio Bacini, Genoa.

Vessel No. 49	Steel	—	—	400	—

SPANISH.

Compania Euskalduna de Construccion y Reparacion de Buques, Bilboa.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
† Upo-Mendi, Turret Schooner	—	Bilbao	—	3,900	320

PORTUGUESE.

H. Parry & Son, Lisbon.

One Barge still in construction, one boiler 12 ft. 6 in. dia. by 12 ft.; 3 corrugated furnaces for Portuguese Government, 2 small paddle steamers river service and machinery, 2 small compound engines for screw launches.

AMERICAN.

The American Car & Foundry Co., Wilmington, Del.

Name of Vessel.	Built of	Owners.	G.T Regis.	G.T. inclu. erect.	I.H.P.
* Lighter, Storm King	Wood	—	1,200	—	600
* 4 Car Floats	,,	—	700ea	—	—

The Bath Iron Works, Bath, Maine.

2 Torpedo-boat Destroyers	—	U.S. Gvt.	742dis(trial)ea	12,000ea
Passenger Steamer	—	probably Portland est.	725	—	2,200

The Bath Marine & Construction Co., Bath, Maine.

55 ft. by 13 ft. Raised-deck Cruiser for N.Y. firm — Wood — — — 25

One Auto Express Boat, 15-H.P., and about a dozen smaller boats of different sizes.

F. S. Bowker & Son, Phippsburg, Maine.

A schooner will be started on next April.

Chicago Shipbuilding Co., South Chicago.

Repair work on hand.

W. Cramp & Sons, Beach and Ball, Philadelphia.

t	Patterson, T.B.D.	Steel	U.S.A.	—	—	12,000ea
t	Battleship Wyoming	,,	,,	—	—	28,000
	4 Car Floats	,,	,,	—	—	—
m	1 Oil Barge	,,	,,	—	—	—

J. H. Dialogue, Camden, New Jersey.

*	No. 438 Tug, Building	Steel	Florida	ab190	—	400
*	No. 442	,,	,,	Philadelphia	100	—	350
	No. 443 Yacht	,,	,,	New York	200	—	800

† Triple. t Turbine. * Compound. m Motor. o Oil.

Dubugue Boat and Boiler Works, Dubugue, Iowa.

Three Steel Tow Boats for U.S. Engineering Co., Kansas City. No. 1 close compound 17 in. × 60 × 26 in. × 60 in.

J. S. Ellis & Sons, Tottenville, Staten Island.

A Tug Boat 97 ft. overall, 21 ft. beam, 10½ ft. hold for the Dalzell line. New York City, and a tug boat for the Hudson Towboat Co., of Hoboken, N.J. 75 ft. by 18 ft. by 8 ft. and a passenger and tow boat for the Westerly Towboat Co., of Westerly, R.S. 75 ft. by 18 ft. by 7 ft. These boats will all be delivered in the spring. Some small boat work is also on hand.

The Fore River Shipbuilding Co., Quincy, Mass.

Battleship, Argentine Navy	Steel	—			
2 Car Floats	,,	New York			
Freight & Pass. Steamer	,,	New Bedford			
Suction Dredger, New Orleans	,,	New Orleans	—	—	2,500
Crest, Trawler	,,	Boston			450
2 Submarines (Holland) Skipjack and Sturgeon	,,				—

Gas Engine Power Co., Morris Heights, New York.

2 Vessels	Wood	N.Y.	180aggr.		675aggr.
1 Vessel	Steel	,,	200		4,500
Small Launches aggr.	Wood	,,	60	—	800

Maryland Steel Co., Sparrows Point, Maryland.

ℓ Neptune	Steel	Balto	—	10,000	7,000

The Moran Co., Seattle, Washington.

3 Submarine Torpedo Boats for U.S. Government.

Moore & Scott Iron Works, San Francisco.

Transport Thomas. Dimensions, 450 ft. by 50 ft. by 30 ft. To furnish new steel spar deck. Largest job of the kind ever undertaken on the Pacific Coast.

Newport News Shipbuilding Co., Newport News, Va.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
Seal and Tuna, Submarines Lake Type, U.S. Navy					
2 Torpedo Boats for U.S. Navy		—			
† W. P. Herrin, Oil Tanker		San Francisco		1,940	2,000
† Corozal & Montoso, Freight		New York		3,200ea	1,800ea

The New York Shipbuilding Co., Camden, New Jersey.

ℓ Arkansas, Battleship	Steel	U.S.A.	—	26,000dis	32,000
ℓ Battleship, 2 masts	,,	Argentine		27,620	45,000
† Suwannee & Somerset, Cargo and Passenger	,,	Baltimore		7,000ea	2,800ea
2 Car Floats	,,	New York	1,000ea	1,000ea	

Perth Amboy Dry Dock Co., Perth Amboy, N.J.

One Steam Derrick Lighter (wood). Capacity of derrick, 2 tons.

Staten Island Shipbuilding Co., Port Richmond, N.Y.

* Ferryboat 532	-	N.J.	-	1,400	
Yacht No. 535, Schooner	—	N.Y.	—	1,600	—
Tug 540	--	,,	--	200	

Southern Pacific Railway, Oakland, Cal.

h Thoroughfare, Side Wheel Team Ferry Steamer	Wood	San Francisco	—	2,662	1,340

Arthur D. Story, Essex, Mass.

Just commencing a Schooner about 115 tons, also a steam vessel about 300 tons.

The Union Iron Works, San Francisco.

g San Pedro, Side Wheel Feathering Paddle Steel ab1,500gross 2,000

4 Submarines for U.S. Navy.

ENGINES.

The Manistee Iron Works Co., Manistee, Mich.

Name of Vessel.	Builders.	I.H.P.	Press. lbs.
Maggie Marshall	Old Boat, Scotch Boiler		140
P.M. No. 3	Passenger Boat, 2 Boilers		140
Steamer Dewar	Passenger Boat, 1 Firebox Boiler		140

CANADIAN.

G. T. Davie & Sons, Quebec.

Plans in hand for two freight and passenger steamers.

Joseph McGill, Shelburne, N.S.

Wooden Schooner, 80 tons, for Newfoundland, to launch Feb. 1st., 1911

Polson Iron Works, Toronto.

96 ft. Passenger and Freight Steamer.

Smith & Rhuland, Lunenburg.

One Schooner (wood) in course of construction of about 100 tons, and contracts for two to be launched early in spring, and for construction during next summer.

AUSTRALIAN.

Morrison & Sinclair, Balmain, N.S. Wales.—A harbour lighter to be launched 19th Nov., 1910; a ferry steamer and another harbour lighter.

Wright & McLaren, Tuncurry.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* Wooden Steamer, schooner rig, length 146 ft.	—	Sydney	250ab	—	200

ENGINES.

Morts Dock and Engineering Co., Ltd., Sydney.

Name of Vessel	Builders	I.H.P.	Press lbs.
† Set Engines for Ferry Steamer		65	150
* Set Engines for Coastal Steamer		200	120

* Compound. † Triple. g Compound Diagonal.
h Duplex Tandem Compound. ℓ Turbine.

JAPANESE.

The Kaimu Sho (Local Marine Bureau), Tokyo.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* Tazuru Maru, No. 1	Wood	Tokyo	—	ab50	—
* Shichito Maru, No. 2, Schooner	,,	,,	—	ab40	—

Mitsu Bishi Dockyard and Engine Works, Nagaaski.

ℓ No. 202, 2 masts	Steel	Osaka	-	6,000	3,900
ℓ No. 203, 2 masts	,,	Tokyo		13,700	16,850
ℓ No. 208, Cruiser		Japanese	-		-
ℓ No. 209, Destroyer		,,	—	—	—
ℓ No. 210, 1 mast	Steel	Nagasaka	- -	215	400
† No. 211, 1 mast	,,	,,	-	189	400
Nos. 212, 213 and 214	,,	—	- -	24ea	—
No. 215 Gunboat	—	Chinese	—	—	- -

The Oaki Shipyard, Tokyo.

* Schooner	Wood	Tokyo	ab1,000	ab600	680

The Osaka Iron Works, Osaka.

1 Steam Trawlers	Steel	Unknown		205ea	410ea
† Cargo Steamer	,,	,,	—	1,050	500

The Uraga Dock Co., Uraga.

r 800-ton Bucket Dredger	Steel	Shimonosiki	—	1,250	1,000
Ferry Boat	,,	Tokyo	—	220	300
† Tugboat	,,	Shimonosiki	—	250	430
* Icebreaker	,,	Ujina	—	65	200

CHINESE.

The Vulcan Iron Works, Ltd., Shanghai.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
m No. 113	Cedar	—	—	-	10B H.P.
m No. 115	Steel	—	—	— 100	,,
m No. 116	Teak		—	— 30	,,
m No. 118	Steel	—	—	— 15	,,

The Yangtse Engineering Works, Ltd., Hankow.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
* Twin-screw Tugs	Steel		130	—	180
* Twin-screw Tugs			130	—	450
Lighters			700	—	—
* Screw Tug			—	—	800
10 Lighters		—	290ea	—	—

HONG-KONG.

The Taikoo Dockyard and Engineering Co. of Hong-Kong, Ltd., Hong-Kong.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect,	I.H.P.
† Harbour Vessel 119	Steel	-	app370	—	750

STRAITS SETTLEMENTS.

Riley, Hargreaves & Co., Ltd., Singapore.

Name of Vessel.	Built of	Owners.	G.T. Regis.	G.T. inclu. erect.	I.H.P.
ℓ No. 266	Wood	Batavia	-	—	110
‡‡ No. 267	,,	,,	—	—	120
No. 268	,,	,,	—	—	—
‡‡ No. 269	,,	--	-	—	100
‡‡ No. 270	,,	--	—	-	140
‡‡ No. 271	,,	Dutch	—	—	53

The Tanjong Pagar Dock Board, Singapore.

* Twin-screw Train Ferry Steamer	Steel	Singapore	—	175	350
* Launch	Wood	,,	-	25	55
* Cargo Steamer	Steel	Dutch	—	135	160
* Tug	Wood	Singapore	--	50	250
* Yacht	Steel	Kedak	—	60	200

To be engined by the Tanjong Pagar Dock Board.

ENGINES.

The Tanjong Pagar Dock Board, Singapore.

Name of Vessel	Builders.	I.H.P.	Press lbs.
* Stock	T. P. D. B.	250	135

* Compound. † Triple. ‡‡ Compound Surface Condensing.
ℓ Compound Non-Condensing. m Motor. r Twin Triple.

GLASGOW TECHNICAL COLLEGE SCIENTIFIC SOCIETY.—At a meeting of this body, held in the College on Dec. 10th, Mr. George Ness presiding, Mr. John S. Glen Primrose read a paper on "Metallography as an aid to the Engineer." Describing first the methods of operation in the micro-photography of metals and the various methods of illumination of the objects, the author showed later the effects of various substances added to irons, and showed the change of structure of steel with different amounts of carbon. The effect of the treatment of the materials was referred to, and a series of interesting lantern slides and actual micrographs were exhibited on the screen to show such faults as slag inclusion, etc., which accounted for the failure of various structures.

SUITABLE PRESENTS are technical books, which may be obtained from the Publisher of this paper on receipt of cash with order.

BOOKS AND CATALOGUES RECEIVED.

Official Year Book of the Scientific and Learned Societies of Great Britain and Ireland, 1910 (27th annual issue). Published by Charles Griffin & Co., Ltd., London.

Les Flottes de Combat en 1911. Commandant de Balincourt, Paris, Librairie Militaire. Berger-Leveault & Co.

Vessels of Various Types, by James Pollock & Sons, Ltd., 3, Lloyds Avenue, London, E.

The United States Metallic Packing Co., Ltd., Bradford, have sent us a copy of their calendar for 1911, embossed thereon with a representation of Paul and Virginia. The calendar is quite a work of art.

WORSHIPFUL COMPANY OF SHIPWRIGHTS.—The Educational Trust Fund Committee of this company, which was formed some few years ago during the mastership of Sir William H. White, K.C.B., F.R.S., for the purpose of promoting the study of naval architecture, has annually granted to various institutions throughout the United Kingdom sums of money to be distributed by them to deserving students in their classes for naval architecture. These young men are thus enabled to purchase books and prizes which will assist their further studies. At the recent meeting of the committee awards were granted for the year to the following: The Armstrong College, Newcastle-on-Tyne; the London County Council School of Engineering, Poplar; the Portsmouth Education Committee, the Devonport Education Authority, the Dumbarton School of Science and Art, the Sunderland Technical College, the Wallsend Technical classes, the Chatham Education Committee, the Sheerness Education Committee, the Belfast Municipal Institute, the Glasgow and West of Scotland Technical Institute, and the Clydebank Technical Institute. During the year the committee have also been able to grant scholarships to students at the Royal Naval College at Greenwich and at the Glasgow University, the funds for which have been placed at its disposal by the Fishmongers and the Skinners Companies.

NORTH-EAST COAST PORTS.—Some of the comparatively little known sea-ports on the east coast of Scotland have been gradually coming into prominence recently, due to increasing trade, and the authorities are showing themselves alive to the developments by meeting the situation and arranging for extensions of quays, harbours and docks. It is sometimes rather later than earlier that the awakening comes, and then procrastination is responsible for the lack of natural progress when the rising tide of trade flows in without the preparations to take advantage of it. Our visits to Anstruther have been made more with a view to sweet sojourns from the stress of business rather than to ponder over the possibilities of harbour improvements, but there is no doubt that the proposals being made by the authorities to deepen and improve the harbour ought to be carried into effect, and we wish them all success in their negotiations for the necessary capital to carry a good, well-considered and extended plan into effect. The immediate object of the harbour improvement is to serve for the fishing fleets, but beyond that the coastal and other sea traffickers might be encouraged to make Anstruther a place of call. Further south, Methil as a coal shipping port has been advancing rapidly in its shipments, these now averaging about 55,000 tons of coal per week. Our early recollections of the neighbourhood contrast vividly with the present realities from a pleasing, peacefulness to coal dust and bustling activity. Stonehaven, too, has been moving ahead, and has obtained a grant to admit of harbour improvement and extension of breakwater to give more adequate protection and berthing facilities. Aberdeen, too, has shown advances in several of the industries connected with the sea and the concessions on the eve of being granted, it is hoped, by the Portuguese will remove some restrictions which will be an advantage to many of the east coast fishing boats, whose venturesome souls cruise so far from home waters. Dundee, with its well-known features and various interests, its own special trades, its shipbuilding and shipowning, has found it necessary to set about dry dock improvements to cope with work on the most modern lines, and while the Harbour Board is about it, the subject should be thoroughly dealt with on the presumption that expedition and facilities given towards the carrying out of work required by customers will increase the harvest derived from dues.

A Marine Enamel.—We have received a pamphlet from Messrs. Duggan, Neal & McColm, Ltd., of Millwall, London, E., descriptive of their "Dodo" enamel and flatting. The enamel is an air-drying compound having distinct advantages over paint. It is said to be more durable, is applied quite as easily and does for itself that which a painter has to do for paint, namely, flows in any position to a perfectly flat even surface, providing the work is properly covered. When dry the surface obtained is equal to the best coach work if the under coat has been properly rubbed down to a good surface. The "Dodo" marine enamel is specially manufactured for use on board ship and in all places subject to the deteriorating effects of sea air and salt water. It has a high covering power, as one gallon will cover 70 to 80 square yards for one coat.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our Own Correspondent.)

THE lock-out of the iron-working section of artizans in all federated yards, after lasting fifteen weeks, as from September 2nd, came to a termination on December 15th, when the notices were withdrawn and the gates opened to the workmen. Some days were occupied in getting matters into trim before anything like the full strength of the working staffs could be re-engaged, but by the 20th all the Clyde yards were again in full swing. The resumption of work, so far as the Clyde is concerned, was accompanied by very consolatory if not compensating circumstances, *viz.*, the placing of two fresh contracts whose importance—even for the Clyde—has seldom been equalled. Messrs. John Brown and Co., Ltd., Clydebank, were commissioned by the Cunard Co. to begin the construction of a new Atlantic liner of unparalleled dimensions and luxuriousness of outfit; and the Scott Shipbuilding and Engineering Co., Ltd., Greenock, were entrusted by the British Admiralty with the building and engining of an improved "Dreadnought" battleship which, like the Cunarder, exceeds everything of its class yet undertaken. With these two items alone—not to speak of the accumulated contracts of the period of stoppage—the wheels of industry on and around Clydeside are again briskly revolving, and to all appearances the settlement of labour difficulties arrived at will enable the wheels to revolve unceasingly for a long period.

Messrs. John Brown & Co. have, in anticipation of the Cunard commission, been clearing away existing structures in their works to enable a building berth of greater length to be laid down than existing, and by redisposition, to take more advantage of the available width of water for "launching run" at this part of the Clyde. The firm have also offered to the Clyde Trustees, and the offer has been accepted, to contribute £10,000 towards the cost of the early completion of the scheme of river widening on the south side of the river, below the mouth of the Cart and adjoining and immediately opposite the Clydebank yard for the whole length of Newshot Isle, which ground has long been acquired by the Trustees for that purpose. There is every likelihood that this important scheme of improvement will now be vigorously proceeded with, and that by the time the great Cunarder has to be sent off the stocks, the water area in the region of Messrs. Brown's establishment will be thoroughly ample and satisfactory. The exact length to be adopted for the new vessel is still the subject of discussion between the Cunard Co. and Messrs. John Brown & Co., Ltd., and a great many matters of detail of considerable importance have still to be arranged between them. But from the figures at present available, it appears that the ship will be about 885½ ft. in length, 95½ ft. in total breadth, will have 50,000 tons displacement, and 40,000 tons gross measurement. Her coal capacity will be 6500 tons and her speed will be 23 knots.

Messrs. The Scott Shipbuilding and Engineering Co., to whom the Admiralty have entrusted the production of the new battleship, which is to be considerably heavier and to some extent larger than the battleship *Colossus*, which the same firm is now completing in their tidal basin, is at present one of the busiest firms on the Clyde. Apart from the

Colossus, the battleship just ordered, and the submarine depot-ship referred to, they have under construction five large liners for the mercantile navy. These include three steamers for the Holt Line, one for the Booth Line, and one for the Donaldson Line, recently placed. All these vessels are of high-class character, elaborately fitted, and thus affording work for all branches of shipyard artizans. Many other of the largest Clyde shipyards have quite a record amount of new shipping to complete and start upon, among whom may be named the Fairfield Co., A. Stephen & Sons, D. & W. Henderson, Barclay, Curle & Co., Simons & Co., Wm. Hamilton & Co., Russell & Co., and Caird & Co.; altogether, the amount of fresh tonnage placed with Clyde builders since the stoppage of work on September 2nd is —on a safe computation—little short of 250,000 tons, about 45,000 tons of which consist of warship work.

Coming now to speak of the year's output, it is not possible at the time of writing to give accurate figures, as full returns are not yet available, although as regards this the elaborate statistics given elsewhere in these pages may safely be consulted. It is also certain that in consequence of the lock-out, a very large amount of tonnage which should have been included in this year's returns will be thrown into next year's. During September, October and November—with the lock-out obtaining all through—the output reached about 70,000 tons, only 2,000 of which were contributed by November—the lowest monthly output for thirty years. The total output for the eleven months consisted of 250 vessels of 366,000 tons, as compared with 202 vessels of 357,550 tons for the like period last year, and 523,600 tons for the same period in the record year of 1907, when the output for the whole twelve months reached 620,000 tons. The present year's output will probably not reach any higher a figure than the 403,000 tons total of last year; but much will depend on what shipbuilders are able to accomplish in the way of launches during the two weeks which still remain of 1910. The workmen themselves have certainly every incentive to swell the output to the highest figure possible.

As regards the work accomplished during the year by individual firms, and the items of greatest note contributing to the year's productions, a few general statements are here given; but for more detailed particulars the reader may again be referred to the statistical information on other pages.

Messrs. Russell & Co., Port Glasgow, who—if not actually at the "top of the poll," are usually found occupying a position near the top—are again on this occasion the premier firm as regards volume of tonnage, their output being in the neighbourhood of 66,500 tons. Second place on the list will be taken by any of three firms—Messrs. Stephen & Sons, Linthouse, Messrs. Chas. Connell & Co., and Messrs. Barclay, Curle & Co., Whiteinch—each of whose output lies within the range of the two figures of 30,000 and 34,000 tons. One or other of these firms may, within the period between the time of writing and the last day of the year, launch one vessel which, seeing the average tonnage of the individual productions of the firms in question is about 6000 tons, may make all the difference between second, third or fourth place on the year's record.

It is very doubtful, however, whether "pride of place" takes this form in the case of any Clyde firm at any annual reckoning, and this is accentuated in the present instance by the exigencies of constructional progress when the lock-out was suddenly declared. Tonnage measurement and money value per ton are widely divergent terms in shipbuilding work anywhere, but particularly so on the Clyde, where variety and specialisation so largely obtain. Naval work generally—whether in the form of battleship, cruiser, or torpedo-boat destroyer—is a section of the year's work on the Clyde, the importance of which is certainly not measured nor even indicated by tonnage statistics. The same is true of the elaborately fitted ocean, channel and river passenger steamers, the small but powerful tugs, and the store-house embodiments of engineering in the shape of dredgers which this year, as in previous years, have formed an essential part of the Clydeside output.

Naval Work—the great bulk of which is for the British Admiralty, the remainder being for the Brazilian Navy—formed no inconsiderable portion of the year's productions. Altogether about 44,000 tons (displacement) of naval work were sent off the stocks and for most part brought to completion. Embraced in this were a battleship—the *Colossus*—of 20,250 tons, two second-class cruisers, each of about 5,000 tons, and as many as twelve torpedo-boat destroyers, ranging from 800 to 970 tons displacement. In addition, there were two destroyers, each of 560 tons displacement, for the Brazilian Navy, launched and completed by Messrs. Yarrow & Co., Scotstoun, whose advent on the Clyde now firmly augments its reputation for variety and highly specialised work.

The propulsive machinery corresponding to the tonnage above stated amounted to as much as 235,000 I.H.P., the great bulk of which was produced in Clyde engineering establishments, a remark which also applies to the miscellaneous auxiliary machinery involved in the contracts. In the case of two firms the output almost entirely consisted of naval work, these being Messrs. Scott & Co., Greenock, whose entire output was embodied in the 20,250 tons of the battleship *Colossus*, and the Fairfield Co., six of whose productions—out of a total of nine—consisted of torpedo-boat destroyers. Other firms whose work to some extent consisted of naval productions were Messrs. John Brown & Co., Clydebank, Messrs. W. Beardmore & Co., Dalmuir, Messrs. W. Denny & Bros., Dumbarton, and Messrs. The London and Glasgow Co., Govan.

As regards mercantile work, the most notable items of the year were the twin-screw steamer *Garth Castle*, of 8,000 tons, built and engined by Messrs. Barclay, Curle & Co., Whiteinch, for the Union Castle Mail Steamship Co.; the twin-screw steamer *Levuka*, 6,280 tons, built and engined by Messrs. Alexander Stephen & Sons, Linthouse, for the Australian United Steam Navigation Co.; the twin-screw steamer *Saturnia*, of 9,000 tons, built for the Donaldson Line, Glasgow, by Messrs. Chas. Connell & Co., Scotstoun, and engined by Messrs. Dunsmuir & Jackson, Govan; the twin-screw steamer *Zeelandia*, of 7,780 tons, built for the Royal Holland Lloyd, Amsterdam, by Messrs. Alex. Stephen and Sons, Linthouse; the twin-screw steamer *Lisboa*, 7,200 tons, built and engined for the Empreza Nacional de Navaegacao a Vapor, Lisbon, by Messrs. D. & W. Henderson & Co., Partick; the twin-screw steamer *Rotorua*, 11,290 tons, built by Messrs. Wm. Denny & Bros., Dumbarton, for the New Zealand Shipping Co., London; notable as being fitted with combination turbine and reciprocating engines. The list of twin-screw steamers of large tonnage might be extended, but, unless in the matter of size, none were distinguished by any features of note. Two paddle-steamers of good speed were produced, the p.s. *Weeroona*, by Messrs. A. & J. Inglis, for South Australia, and the *Eagle III.* by Messrs. Napier and Miller, Ltd. A high-speed turbine Channel steamer in the *St. Petersburgh*, of 2,600 tons, by Messrs. John Brown and Co., Clydebank, for the Great Eastern Railway Co., Harwich, also calls for mention. In the matter of dredgers the most notable product of the year was the *M.O.P. 210 C.*, of 2,000 tons, built by Messrs. Wm. Simons & Co., Renfrew, for the Argentine Government. This vessel, with a dredging capacity of about 6,300 tons per hour, actually on trial lifted soft clay at the rate of 12,600 tons per hour.

Shipbuilding operations on the east coast of Scotland—the Forth, the Tay, and the Dee—and at outlying ports, were during the year disappointingly meagre. Altogether the output from the three rivers named has so far not amounted to more than 25,000 tons. On the Forth and Tay, the latter especially, the output for many months of the year was *nil*. On the Dee, on the other hand, there has been constant activity, the bulk of the work consisting of small-sized vessels such as trawlers and drifters. An exception of distinctly notable character was the launch in September, by Messrs. Hall, Russell & Co., Aberdeen, of the steamer *Intaba*, for Messrs. J. T. Rennie, Sons & Co., of London and Aberdeen, which was not only the largest vessel ever built there, but was of special interest on account of its being the first vessel built on the "Isherwood" system to have a Board of Trade passenger certificate.

MESSRS. COCHRAN & CO. (ANNAN), LTD., have supplied a Cochran Annan donkey boiler with patent seamless furnace to the s.s. *Tenger*, built by The Antwerp Engineering Co,. and which vessel has just completed her official trial trip.

REFRIGERATING APPARATUS FOR MARINE TRANSPORT.—Our next article will deal with the construction of the cold chamber.

TYNESIDE AND WEARSIDE.

(From our Own Correspondent.)

Tyneside.

AT the present date the marine engineering fraternity on Tyneside is possessed of mingled feelings. The first is a profound sense of relief that the fourteen-weeks lock-out is over at last, and that there appears to be a chance of pushing forward the orders which, in spite of uncertainty as to date of completion, have been accumulating. There is evidence to show that there will in a short time be a state of activity in the yards corresponding to that of the "boom" periods, though it may take a little time to get the work through the drawing offices.

Not so pleasant is the news which has come to hand during the month that Tyneside is not to build the giant Cunarder. Everyone in this locality expected that Messrs. Swan, Hunter would get the order. In this connection the sentiments expressed by Mr. G. B. Hunter at the local annual dinner of the Foremen's Mutual Benefit Society may be quoted to the effect that it was not because the resources of this area were not adequate to deal with the contract or that the steamship company had been dissatisfied with their Tyne-built boats in the past.

The Tyne and Solway Canal.—This huge engineering project has been the subject of discussion at the North-East Coast Institution of Engineers and Shipbuilders, Mr. Gedge, of the River Tyne Commissioners, estimating that the figure of £50,000,000 for the work was below the mark, as no provisions had been included for cost of works on the Tyne below Ryton. Mr. Sandemann, the originator of the proposition, thought on the other hand that his figures would hold good. There was not much prospect in the near future of carrying the work through, but he submitted that a navigable Tyne as far as Hexham would be of immense benefit to the district. The subject was interlinked with that of making the Tyne a naval base.

Messrs. Armstrong, Whitworth & Co., Ltd.—Work is in a very forward state in connection with the Walker site, excavating work being pressed on rapidly. It is probable that extra night work may be adopted. There has been a Local Government Board inquiry concerning rights of way at the institution of Messrs. Dobson. An interesting point which has been stated in the local press in connection with the matter is that about 10,000 men will probably be employed at Walker in addition to about 5600 at Elswick. The firm is now busy finishing the *Weymouth*, which was launched with the boilers on board, and now that the men are back the battleship *Monarch* is being pushed on.

Messrs. Palmers' Shipbuilding and Iron Co., Ltd.—It is now stated as an accomplished fact that this firm has entered into possession of Messrs. Stephenson's yard at Hebburn. The local press also states that alterations are probably to be made to the railway arrangements at Jarrow to meet the changed conditions, and that the office staff of the works will be transferred to Hebburn. Extensive changes in the works lay out are probable. Among recent orders is one for a merchant vessel for the meat trade, carrying about 4000 tons.

Messrs. Eltringham, Ltd.—This South Shields firm has an interesting boat under construction—the *Holzapfel I.*, which will be the first suction gas-driven merchant vessel afloat when it is launched. Other vessels are also in course of construction.

Messrs. The Mercantile Dry Dock Co., Ltd.—This firm is making important alterations and extensions to its yard and work equipment, involving considerable use of electric power. This has already been adopted by this firm, and the extensions indicate their satisfaction with this power agent.

Messrs. J. Readhead & Sons, Ltd.—This shipbuilding yard is now highly busy with three boats which are now in the yards awaiting completion.

It is rumoured that the British Government is shortly to give out orders for three large battleships, two of them to be of the "Dreadnought" type, and it is hoped in some quarters that one of these may come to the Tyne.

Blyth.—Progress is being made in the development of this port. The North-Eastern Railway is improving the staiths so as to facilitate the coaling of vessels. They also propose to run a new line passing from Monkseaton, through Seaton Sluice, to Blyth, which will contribute enormously to its development. Trouble which was occurring between the Harbour Commissioners and the Blyth Council with regard to a crossing in connection with the harbour has been satisfactorily adjusted.

Wearside.

Great satisfaction has been expressed on Wearside that the lock-out has finished. So heavy is the rush of work now that the ban has been removed that there will only be two days, Boxing Day and the 2nd of January, for holidays, and overtime is to be worked as much as possible. Where work is so plentiful it is wondrous to differentiate, and as regards actual accomplishments, the resumption of work is so recent that it is rather difficult to report progress. One feature of the orders in hand is that in a good many instances no pressure is being made for early delivery, probably because the shipping industry has not yet come to the end of the additional tether given it by the alterations of the Plimsoll mark. Production is, however, expected to be in brisk demand in the near future, and it is hoped that prices will show better margins.

A rumour is current that a firm building small vessels is about to establish a yard of considerable dimensions on the Wear, and has already entered into negotiations for a section of river frontage.

Messrs. J. L. Thompson & Sons, Ltd.—Among recent orders received by this firm is one for an 8400-ton deadweight capacity merchant steamer. The remarks made above apply to this yard, as to others, as regards activity.

Messrs. Richardsons, Westgarth & Co., Ltd.—It appears from the present position of this firm that the severe depression which has affected the trade generally is being alleviated. The tenth annual report indicates that all their three works, including that at Sunderland, have been well maintained. Among recent orders is one for engines for three vessels each of 7500 tons carrying capacity, built by the Northumberland Shipbuilding Co., of Howden, and sets of engines for two colliers being built by Sir Raylton Dixon & Co., of Middlesbrough.

Messrs. S. P. Austin & Son, Ltd.—This firm, among other work, is completing a vessel for Messrs. W. Cory & Son, Ltd., which was recently launched. She is of 3100 tons deadweight capacity and is the twenty-first vessel Messrs. Austin have built for this firm.

THE TEES AND HARTLEPOOLS.

(From our Own Correspondent.)

Messrs. T. Smailes & Son, Whitby, are reported to have placed an order for the construction of a cargo steamer with Messrs. R. Thompson & Sons, Sunderland, about 350 ft. by 50 ft. by 25 ft. 10 in. deep, the machinery to be supplied by Messrs. The North-Eastern Marine Engineering Co., Sunderland, having cylinders 25, 42 and 68 in. diameter by 45 in. stroke.

Middlesbrough.

Messrs. Sir Raylton Dixon & Co., Ltd., Cleveland Dockyard, are reported to have secured two orders during the month, and are expected to be fairly busy during the year, and anticipate securing an order for local owners shortly.

Messrs. W. Harkess & Son are only moderately busy, but are likely to secure the order for a small steamer that is in the market.

Messrs. Smiths' Dry Dock Co. are busy in all departments, both repair and new work, and are expected to have a very good year.

Messrs. Richardsons, Westgarth & Co. keep busy; they have a fair amount of work on hand. It is reported that Mr. Tom Westgarth has entered into an agreement with Dr. Diseel on behalf of the firm for the sole rights of manufacture of the marine oil engine. It is also reported that Messrs. Furness, Withy & Co. have placed an order for the complete installation of two sets of machinery to be fitted to two cargo steamers they intend building, which will be the first time in this country that oil engines are to be fitted in large steamers.

Stockton and Thornaby.

Messrs. Richardson, Duck & Co. are reported to have secured an order, and the prospects are said to be very good for a busy year.

Messrs. Craig, Taylor & Co. are reported to have secured the order from Messrs. I. Chambers & Co., Liverpool, to build a large cargo steamer of about 8,000 deadweight, and are now fairly busy.

Messrs. R. Ropner & Sons are now getting somewhat more busy, as they are reported to have secured another order during the month.

Messrs. Blair & Co. are fairly busy; they are reported to have secured the contract to supply the engines and boilers for the steamer to be built by Messrs. Craig, Taylor & Co. for Liverpool owners. They are also stated to have secured orders for other two sets of machinery for steamers building locally.

West Hartlepool.

Messrs. Furness, Withy & Co. are reported to have sold a steamer building to their order by Messrs. Irvine's Shipbuilding and Dry Dork Co.; also the following steamers, the s.s. *Acara*, 4982 g.t.; *Langdale*, 3930 g.t.; *Swaledale*, 3658 g.t.; and *Wensleydale*, 3964 g.t.; all to Mr. J. J. A. Van Meel, Rotterdam.

Messrs. W. Gray & Co. are very busy with new work. Amongst the later contracts is a steamer for Messrs. O. Trechman & Co., West Hartlepool. They are also very busy on repair work.

Messrs. Irvine's Shipbuilding & Dry Dock Co., Harbour Yard, are reported to have secured an order to build a cargo steamer similar to the boat ordered by Messrs. Milburn and Lund for local owners.

The Central Marine Engine Works are very busy, to keep pace with Messrs. W. Gray & Co.'s two shipyards, having a lot of work on hand.

Hartlepool.

Messrs. Irvine's Shipbuilding & Dry Dock Co., Middleton Yard, have secured the contract to build a large twin-screw steamer for Liverpool owners about 440 ft. long by 58 ft. beam, 13 knots, for the frozen meat trade.

Messrs. Richardsons, Westgarth & Co. are fairly busy. They are reported to have secured the contracts to supply the engine and boilers for the cargo steamer to be built by Messrs. Irvine's Shipbuilding & Dry Dock Co.; also the twin-screw steamer, which will be supplied with Howden Forced Draught System, of 6000 I.H.P. and similar to the t.s. *Indrabarrah*, which has given such excellent results, as set forth in a paper on steamship auxiliaries read by D. B. Morison, Esq., before the North-East Coast Institute of Engineers and Shipbuilders at Newcastle. They are also very busy with orders for their "Contraflo" Condensers.

THE HUMBER AND DISTRICT.

(From our own Correspondent.)

Messrs. Earle's Shipbuilding and Engineering Co., Ltd., have not much to report, the great lock-out of the boilermakers having kept trade back, but the clang of the hammers is now sounding throughout the yard again. A fair number of orders are in hand, also repair work.

Messrs. The Hull Central Dry Dock and Engineering Works, Ltd., have had a fair month, and the following steamers have been in their graving dock:—s.s. *Douglas*, s.s. *Skepsea*, s.s. *Cvforthja*, s.s. *Bondecar*, s.s. *Togston*, s.s. *Baron*, s.s. *Driesen*, s.s. *Dot* and s.s. *Balcuyle*, several undergoing Survey through Lloyds. Repairs have been done on s.s. *Orlando*, s.s. *Prudentia*, s.s. *William Balls*, etc. The Company's graving dock is well booked in advance.

The North-East Coast Engineering Works.—Rapid progress is being made by this firm, whose works are situated at the entrance of Alexandra Dock, and close to the graving dock and Hull and Barnsley Railway. They are leasing more land and extending their yard, and laying down extra plant. Recently they have been employed on the following steamers:—s.s. *Ilderton*, s.s. *Peerless*, s.s. *Etton*, s.t. *Belle of the Usk*, s.t. *Swift*, also sailing-ship *Viking*. Several steamers have been booked for graving dock, for the month of January.

Messrs. Amos & Smith, engineers, Albert Dock Works, are well employed with new work, engine and boiler shops being worked overtime. Three more sets of machinery for trawlers for local owners and two sets of machinery for hoppers for the N.E.Ry. and Dock Co., also another set of machinery for Russian shipbuilders have just been booked. Now the boilermakers have returned to work, the firm are again in a position to compete for any light or heavy repair work on ships, dry-docking, etc.

Messrs. Stewart & Craig, engineers and boilermakers, have had the following steamers undergoing repairs:—s.s. *Ardandearg*, put in graving dock, bottom sighted, cleaned and painted, also extensive engine-room and deck repairs; s.s. *Escolbrook*, deck repairs; s.s. *Whaleley Hall*, general repairs, deck and engine-rooms; s.s. *Adalands*, damage repairs on deck, and several minor repairs on other steamers.

Thomas Tate, Clarence Street Engine Works, have been fairly busy on the following steamers:—s.s. *Benacre*, s.s. *Heinrich Roberts*, s.s. *Balmyle*, four coasting-steamers, and two German steamers. In addition they have put three sea-going tugs through hull, engine and boiler surveys.

Messrs. Cooper & Co., Neptune Engine Works, have been very busy on general repairs and dry-docking of steamers, and the works have been kept in full pitch, with all machinery fully engaged. The branch shop at Alexandra Dock has also been kept busy with deck and engine-room repairs and dry-docking. The two graving docks owned by Messrs. Cooper and Co. in the old harbour are well booked up.

Messrs. Woodall & Co., engineers and boilermakers, have had an exceedingly good month on repair work, mostly employed on Norwegian, Swedish and Danish steamers. They are forming a good connection with owners of steamers in those countries. The general smith shop is busy with forgings for railway companies and Corporations, and, in addition, orders are being executed for Britain and foreign countries for Messrs. Woodall's heavy purchase block gears.

Messrs. C. D. Holmes, Ltd., engineers and boilermakers, have had a fair month in repair work around the several Hull docks. The branch works, situated at Alexandra Dock, has also been busy with engine-room and deck repairs. Orders for several sets of machinery for local trawler owners have been secured, and a number of inquiries for new and repair work have come in.

Messrs. Cochran & Sons, shipbuilders, Selby, fully expect to be busy for some time, as they are booked well up, for local and outside owners.

Messrs. Cook, Welton & Gemmell, shipbuilders, Beverley, are well started again now, and have booked several trawlers for local owners.

It is understood that the owners of the Wilson Line have given out orders for nine new steamers building in the North and on the Clyde.

SOUTH OF ENGLAND AND ISLE OF WIGHT.

(From our Own Correspondent.)

Messrs. John I. Thornycroft & Co., Ltd., Southampton.—H.M.S. *Larne*, *Lyra*, *Martin* and *Minstrel*.—The second of these vessels has completed her official speed and fuel consumption, etc., trials. H.M.S. *Martin* was launched on the 15th of last month with turbines, boilers and guns mounted. A sister ship, the *Minstrel*, was also launched about the end of last month. H.M.S. *Acheron* and *Ariel*.—The work of erection of the bulkheads and beams on these vessels is completed. Paddle steamer *Arabia*.—This vessel, after having been completely erected, was dismantled and shipped in sections for re-erection at Cairo. *Rocklight of London*.—This petroleum barge will shortly be launched. Barge for Portsmouth Dockyard.—Work is proceeding on this vessel, and the shell plating is completed. Launches.—The three 63 ft. motor boats for Bagdad have all been shipped after successful trials, each having exceeded the contract speed by more than 1½ knots. The 60 ft. twin-screw launch for the Amazon ran her trials last month. Stern-wheel passenger steamer for the Persian Gulf.—The screve boards for this vessel were prepared about the middle of last month, and a start has been made on the construction. New orders.—Last month the firm received an order from the Turkish

Government for ten armoured motor patrol boats, each to be fitted with two 37 mm. guns. These vessels will be propelled by twin Thornycroft motors of the C6 type, and will have a speed of 11 knots. Repairs department.—Last month this department were busy with the steam yachts *Erin*, *Rovenska*, *Miranda*, *Maund*, H.M.S. *Julia*, dredger *Mercurius*, s.s *Plassy*, *Rohilla*, *Sandfly*, and sundry pinnaces, etc.

Messrs. J. Samuel White & Co., Ltd., East Cowes, Isle of Wight.—H.M.S. *Redpole* torpedo boat destroyer completed her official trials last month, all of which were highly satisfactory. On the full power trial the contract speed of 27 knots was considerably exceeded. She was undergoing examination at the end of December preparatory to being handed over to the Admiralty. Orders for a number of naval steam boats have recently been booked by the firm.

Messrs. Day, Summers & Co., Northam, Southampton.—The keel for the new paddle boat, for which this firm recently booked the order, was laid last month, and work is also proceeding on several vessels laid up at the yard for repairs.

The Dredging Question at Southampton.—A meeting of the Harbour Board was held on the 20th of last month, when the following resolution was brought forward by a member of the board:—"That the resolution of the special sub-committee adopted by the board 15th November, *viz.*, that the special sub-committee recommend the board to dredge the Channel from Fawley Beacon to within 600 ft. off the docks to 35 ft., and authorize the Works Committee to advertise for tenders for carrying out the work, be and the same is hereby rescinded, and if rescinded to move 'That the Channel be dredged from Fawley Beacon to within 600 ft. of the Docks to 35 ft., provided that the directors of the London and South-Western Railway are prepared to contribute a moiety of the cost of the undertaking.'" The result of the discussion on the above resolution was not known before going to press.

THAMES.

(*From our Own Correspondent*).

Shipbuilding.—It is understood the Thames Ironworks Co. will launch H.M.S. *Thunderer* on January 17th, the keel having been laid on April 13th last, so that a little over nine months will have been occupied in the building of the hull, should the date for launching be adhered to. After entering the water the vessel will be taken to Dagenham, where a specially constructed berth is in course of preparation, when the vessel will be completed prior to being handed over to the Government. While constructing the largest vessels, the Company executes smaller orders, and has lately built a lifeboat of the whaler type for the institution, of 30 ft. long by 7 ft. 3 in. beam, fitted with a drop keel and pulling eight oars. The boat has been despatched to Dublin Bay.

Messrs. Rennie & Co., of Greenwich, have lately built a motor barge for Trinidad, and also a steam yacht to the order of the Port of London Sanitary Authority. As in an early issue we hope to illustrate these boats, we postpone further description.

Shipping Companies.—The P. & O. Co. has held its annual meeting, and this was the seventieth, the Company having received its charter in 1840. The Company now does not appear to receive so much support from mails as it did at one time, and it is possible that those for the Far East may be at no distant date carried over the Siberian Railway. The accounts show an increased profit of over £80,000, and with over a half-million written off the cost of the fleet, a balance of £67,000 is carried forward. The book value of the fleet stands at a little over £5 per ton. The purchase of the Blue Anchor Line was noted. Five steamers, aggregating 30,000 tons, have been acquired at a cost of £250,000. A sum of £25,000 was paid for goodwill and compensation. This purchase has been made to cater for the emigration traffic, now so rapidly developing. Two new vessels of 11,000 tons each are being built in this connection, and these, with the two new mail boats *Medina* and *Maloja*, will give the Company 454,000 tons under the one flag. The increased receipts are due mainly to freight and not to passenger, and the policy of extending the service of the mail steamers to New Zealand meets with success. That a dividend of 9 per cent. is paid on the stock shows the Company had a good year, and this in every one of its branches. We have also the report of the Orient Co., which pays 5 per cent. on the Deferred Shares, and after allowing for depreciation and the Preferred dividend, there is £109,212 available. The great change has been made by the Company, and it has been abundantly successful. Besides the five mail steamers of over 12,000 tons, a sixth has been ordered on the Clyde from Messrs. Jno. Brown & Co., Ltd., and this is 13,000 tons. This vessel, named *Orama*, is due in September next. A vessel the Orient has been sold at a good figure and with such a trade, the gross amount being nearly £300,000, the Company has never had its equal, which goes to prove that Australia is booming at the present time. A London Company, the Glen Line, associated with China and the tea trade, is said to have become connected with Messrs. Elder, Dempster & Co., which firm has hitherto had no direct connection with Eastern trade.

Port of London.—A change, coming into operation the 1st of this month, is a uniform charge of 1/3 per net register ton for the use of any of the docks for a period of ten days, whereas formerly, taking the London and India Docks, it was 1/6 for twenty-eight days. The alteration will produce an apparent loss of revenue of £15,000 a year, but it is expected to lead to the greater use of the docks and the port generally, and so improve the revenue. It is understood a site has been acquired at Trinity Square for the future headquarters of the Authority, and application will be made to Parliament next Session for the necessary powers. At present the staff is distributed in different directions, and will, if the change is made, be all under one roof and in a good central position, near Tower Hill, and in the vicinity of the London Docks.

Board of Trade Enquiry.—The lamentable loss of life entailed by the disaster to the *Waratah* has at length culminated in an enquiry, and the evidence, so far as it has gone, is interesting from a technical standpoint, as well as from the financial side. It was the vessel's second voyage, and she had reached Durban from Sydney, and between there and Capetown disappeared without a vestige of her being seen afterwards. There were 8812 tons of cargo, and at Durban 20,000 gallons of water were taken in and 1925 tons of coal, of which 250 tons were placed on the spar deck, giving a mean draught of 23 ft. 3 in. on leaving port. We mention these figures because it is a question of stability at issue, and which has to be determined by the enquiry. The matter is being closely watched both here and in Australia.

Poplar Hospital.—This institution, placed in a central position for the docks, had its fifty-fifth festival dinner, at which Sir O. Philipps, Vice-Chairman of the Port of London Authority, presided; and at the table with him were Lord Pirrie, the Hon. Sydney Holland, Vice-Admiral Field, and many others. It was mentioned that since the construction of the *Dreadnought* there had been 345 accidents admitted from the Thames Ironworks. It is satisfactory to note the Committee of King Edward's Hospital Fund describe this as a well-managed and economical institution.

MERSEY AND MANCHESTER SHIP CANAL.

(*From our Own Correspondent*)

NOW that the disastrous boilermakers' strike is happily ended, after fifteen weeks of comparative idleness, this district should have a period of keen activity. Some £1,000,000 has been lost in wages alone, and this has meant a considerable local loss. With still further important Admiralty work, besides a fair number of enquiries for new merchant work, all the resources of this centre will be fully occupied.

Messrs. Cammell, Laird & Co.—Full time was resumed in this yard on December 15th, when large squads of men were put on to complete the various contracts in hand. The good news that the strike had come to an end was supplemented by the confirmation that this firm have secured an order for a battleship of the improved "Monarch" class from the British Admiralty. This huge war vessel will have a displacement of about 24,000 tons, and will cost £2,000,000. The large floating dock is making good progress, and the destroyers *Lapwing* and *Lizard*, together with the two tenders for the submarine depot ship, are now being rapidly advanced. The machinery for the *Blonde* is now practically

on board, and this vessel's trials are expected to take place early in January. The machinery for the four Argentine destroyers is now well ahead of the vessels; the hulls, however, will be completed as soon as possible. The L. & S.W.Rly. steamer *Sarnia* will have run her official trial ere this is in print. The Amazon river steamer *Ceara* will, it is hoped, leave Liverpool for Para before Christmas. The *Highland Loch*, the third Nelson Liner, is practically ready for launching, while four steel barges to the order of Messrs. Hay & Smart are nearly complete, and will be shipped out to South America in three sections. The three poling canoes for the Niger Company are well in frame, and two stern-wheelers for abroad are also now being advanced as rapidly as possible. Various large extensions are being made to the plant and buildings to cope with the large variety of work now in hand. The repair department has had a Liverpool ship in graving dock. She has been sold and been fitted up as a hulk to be used on the west coast of South America. The Liverpool tug *North Cock* and the steamer *Laura* have been in for repair and left.

Messrs. H. & C. Grayson.—The growing importance of the Mersey in connection with repair work is indicated by the large number of contracts in hand, this firm recently having as many as thirty vessels, from coasters to liners. Some of the fastest and ablest of tugs to be seen in this country have been built by this firm, and the last two just completed for the C.P.R., belong to a series, the first being the *Bison*. This firm are now building for the P.S.N. Co. a special type of tug and river-boat for the West Coast of America. The Bibby Liner *Chester* has had extensive alterations after being sold for Chinese service. The steamers *Rameses* and *Adela* have had collision damage and repairs, while the *Venetia* and *Romney* have been in for overhaul and repairs. The Booth liner *Justin* has undergone alterations to provide more passenger accommodation.

New Atlantic Tonnage.—It seems likely that for the St. Lawrence route several lines have new vessels already contemplated. The Canadian Pacific are expecting, it is reported, to have in view the placing of two or even three new vessels faster and bigger than the *Empress* boats on the Canadian service, with a shaft horse-power of 45,000. Mr. Ismay intends, it is said, to place two more boats for Canada, larger and more powerful than the *Laurentic* and *Megantic*, while the Allan Line are shortly to place orders for two vessels, and the Royal Line have recently purchased the *Volturno* from the Rotterdam New York service to enter the Bristol Canada service.

New Manchester Steamship Line.—Next spring, when the Baltic Sea traffic opens, a steamship service is to be inaugurated between Pernan, in the Gulf of Riga, Russia, and Manchester. The monthly service will be carried on by first-class steamers, adapted for the trade; the chief cargoes will be pulp, flax and timber. The managers will be Messrs. A. Coker & Co., of Liverpool and Manchester.

White Star Line.—Mr. John Lee, Vice-President of the International Marine Co. and manager of the White Star Line at New York, retired at the beginning of November. Mr. Lee, who is a native of Derby, was the recipient of a cheque for 1000 guineas and will receive an oil painting depicting the pioneer steamer *Oceanic* and the titan *Olympic*. The death took place recently of Mr. R. S. Cortis, who was the New York agent for the Company in the eighties. With the closer amalgamation of the White Star, Dominion and International Company's staff at the New Year, Mr. John E. Willett, the manager of the Dominion and American Line Liverpool service, will retire. Mr. Willett joined the old firm of Messrs. Richardson, Spence & Co. in 1869, being made a partner in 1898.

Cunard Company.—The order for the new gigantic liner has been placed with Messrs. John Brown & Co., Ltd., of Clydebank.

The International Vanadium Company, Ltd.—This Company has established at its works at Garston, an industry which is not only new to the Liverpool district, but also to the British Isles, seeing that there is no other Company manufacturing alloys of Vanadium completely from the ore. The Company owns, through its agents the General Vanadium Company of America, Vanadium Ore mines of an extensive character, and also purchases from time to time other ores which are offered from all parts of the globe. The manufacture of Vanadium alloys involves highly-technical superintendence, but the majority of the staff of chemists at Garston have been associated with the industry for a long period, working under the supervision of Mr. J. Kent Smith, whose name is specially known for his valuable work in connection with the development of Vanadium steel in this country and in America.

NORTH-WEST OF ENGLAND.

(From our Own Correspondent.)

Barrow-in-Furness.—The chief item of news this month, so far as Barrow is concerned, is the order secured for a gigantic battleship-cruiser for the Imperial Japanese Navy by Messrs. Vickers, Sons & Maxim. It is officially stated that this order has been given to British shipbuilders because of the excellent work they do, the great satisfaction the Mikado's Admiralty have had in British-built ships, and the desire to show there is something in the alliance with Japan after all. The negotiations in connection with the placing of this order were kept very secret indeed, and it was, therefore, quite a surprise when it was announced that the order had been actually placed. It is made a strict condition that none of the details of the plans or the construction of this ship shall be made known to the public. All that is known is that the order represents two millions and a half of money, and that it is to be delivered at as early a date as is now the custom with a British warship. The vessel, it is also understood, is to be larger and of more fighting power than the British *Lion* and the *Princess Royal*, the latter vessel being now in course of erection in the Barrow yard of the Vickers Company. The selection of the Vickers Company to build this ship is, of course, a great feather in the cap of these builders, as it proves that the Japanese Government are well satisfied with the work done by these builders in the battleships *Mikasa* and *Katori*, and in the submarines and other orders which have been built for the far east. It will mean an immense amount of work for Barrow coupled with the other orders which are in hand, and it will make the firm possibly busier than ever they were in their history.

The Boiler-makers' Dispute.—It is a source of great satisfaction that the boiler-makers' dispute is at an end, as it was beginning to make its influence felt not only in the stoppage of progress in Vickers' yard with some very important contracts which were accepted on the time limit, but also because it was responsible for a great amount of distress among men, women and children. The labourers and their families were especially hard hit, as when the lock-out occurred they were without resources, and a special fund had to be started by the Mayor of the Borough for their relief, and the Vickers firm contributed largely to this means of alleviating the distress. The men resumed work just a week before Christmas, and will thus have something to live upon until the holidays are over. It is generally believed the new agreement come to will be a lasting one, as both sides have had enough of strikes and lock-outs, and they think now that means have been provided for the settlement of all disputes as they arise, without the barbarous resort of stopping work, with all its attendant evils. One thing is certain, and that is that now they have returned to work there is plenty of it to do. In every department of the local yard there is quite a full programme of work in hand, and it is recognised that the New Year will be one of the busiest times ever experienced.

The "Princess Royal."—The progress in the construction of this battleship cruiser for the British Admiralty, has, of course, been much delayed in consequence of the boiler-makers' dispute, but now the work is going merrily along, and the builders hope they may be able to make up all arrears, so as to be able to give delivery to the Admiralty within the two years permitted when the order was given out. The Vickers firm have better facilities for completing a big job like this than most firms in the country, and they will bring all their resources to bear in order to make up for lost time, but at present they are not able to get as many men on the job as they require. They need at least another hundred sets of riveters, and in other trades they are also short of the full strength of men needed. This is, of course, a difficulty which might have been expected when the lock-out lasted for so long a time, but it is expected now that the difficulty is at an end more men will be available, but as the same sort of things is probably being experienced in

other yards, it is quite on the cards that men will be difficult to find.

Smaller Vessels.—Progress is being made with several smaller vessels on the stocks, including the Chinese cruiser, one British cruiser of the improved "Liverpool" class, a torpedo boat destroyer for the British Navy, a salvage-boat to attend on the British submarine flotilla, and several submarines.

The New Cunarder.—Much regret was felt at Barrow that the Vickers firm missed the order for the new Cunarder, which went to Messrs. John Brown & Co., as it is known that Barrow builders are determined to get into the trade of building great ocean liners, and with that view their works have been equipped with the special tackle and machinery for this purpose. It is, however, expected they will be able to secure orders of this type in the early future.

Engineering.—The engineering shops at Barrow, which are known to be the largest and best equipped in the world, are especially full of work at the present time, as, in addition to a great deal of work in the building of gun mountings for the home and foreign Governments, they have in hand the turbine machinery for the *Princess Royal*, the *Rio de Janeiro*, building at Newcastle, the turbine machinery for the Japanese battleship-cruiser, and the turbines for the *Dartmouth* and the torpedo boat destroyer, together with other minor work.

Last Year's Shipbuilding.—The shipbuilding returns for the year just closing do not show a great deal of work, inasmuch as much progress has been made with orders which are well advanced, and will be included in next year's returns. The total tonnage launched was 18,130, and the total indicated horse-power constructed was 90,000.

BELFAST.

(From our Own Correspondent.)

1910 and 1911.—The past year has been a prosperous period for the local shipbuilders, as the Output Returns show, and the volume of work on order is sufficiently large to ensure brisk times during the coming year, and for some considerable time beyond.

Messrs. Harland & Wolff have completed their output of tonnage for 1910 by the launch of two large steamers within three days—the P. & O. liner *Maloja* and the Hamburg-America Company's *Bayern*. A sister-ship of the latter vessel, named *Sachsen*, was put in the water a few weeks since. At the present time the Queen's Island firm have five vessels at the fitting-out wharves—the three steamers above mentioned, the White Star liner *Olympic*, and the Aberdeen liner *Themistocles*—representing an aggregate of over 80,000 tons, which probably constitutes a record. The finishing touches are being put to the *Themistocles*, and rapid progress has been made with the fitting out of the *Olympic*, into which all the heavy lifts have now been put. All the berths in both the north and south ends of the yard are occupied with vessels in various stages of construction, and on one of the big slips at the north end three keels will be laid down—two tenders for the White Star line, and the new vessel for the Belfast Steamship Company's passenger service between this port and Liverpool. The Anglo-American Oil Company's barge *Navahoe*, built at the Queen's Island in 1908, has arrived here for repairs. The *Navahoe* carries 10,000 tons of oil in bulk.

Messrs. Workman, Clark & Co.—This firm's yards are also fully occupied, and they have sufficient orders in hand to keep things going in full swing for a considerable time to come. Two steamers recently launched by them are nearly ready for sea; these are the British India Steam Navigation Company's *Arankola*, and the Holt liner *Ascanius*. The twin-screw steamer *Verona* (Società di Navigazione a Vapore Italia) which recently sustained very heavy machinery damage, has arrived here for repairs. The *Verona* and her sister-ship *Ancona* were built by Messrs. Workman, Clark and Co. in 1908.

Messrs. MacColl & Co. have received an order for twin-screw engines of 1400 I.H.P. for a steamer to be built by the Dublin Dockyard Co. for the Union Steamship Co. of British Columbia, Ltd. This is the second steamer ordered by the same owners from the Dublin Company, and the third engined by Messrs. MacColl & Co.

Harbour Notes.—Good progress is being made with the cutting out and deepening of the turning basin at the south end of the Twin Islands, and with the deepening of the Victoria Channel to enable the big White Star liners to leave the port. The new graving dock will be opened early in the new year; the dock itself was completed some time since, but there is still some work to do in connection with the caissons before the cofferdam can be removed from the dock entrance. The particulars of the new dock are:—Length overall, 887 ft.; breadth at entrance, 96 ft.; and depth on sill at ordinary spring tides, 35·3 ft. The depth of water on the sill at highest spring tides and at lowest neaps is 39 ft. 11 in. and 30 ft. 4 in. respectively.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Trent.—On November 4th, a steel steamer of about 525 tons gross, named *Trent*, was launched at Goole, to the order of Mr. E. D. Hutchinson, of Hull.

Ceara.—On November 19th a steel schooner-rigged steamer, named *Ceara*, was launched at Birkenhead, to the order of Messrs. R. Singlehurst & Co., of Liverpool. Messrs. Wailes, Dove & Co.'s "Bitumastic" cement was applied to bottom and their "Bitumastic" enamel to floors fore and aft, also to bunkers, peaks, etc. A Cochran (Annan) donkey boiler, with patent seamless furnace, has been supplied and fitted.

Kirkwood.—On November 29th, Messrs. Robert Thompson and Sons, Ltd., launched from their Southwick Yard the finely-modelled self-trimming collier *Kirkwood*, built to the order of Messrs. Wm. France, Fenwick & Co., Ltd., of London and Sunderland. The vessel is a sister-ship to the *Wedgwood*, recently built by them for the same firm, and is of the raised quarter and well-deck type, and built to the highest class at Lloyds. Her principle dimensions are:—Length overall, 274 ft. 3 in.; breadth, 38 ft.; depth moulded, 18 ft. 2 in.; and she will carry about 2310 tons deadweight on a light draught of water. She is fitted with bulb angle framing, the holds being left clear of all obstructions. There are four very large hatchways, arranged to make her perfectly up-to-date as a self-trimmer and to facilitate rapid loading. Four powerful steam winches with latest improvements are supplied, with steam from a large vertical donkey boiler, and in addition to the usual derricks, four gaffs are fitted, the masts being strengthened for this purpose. To enable her to make quick return voyages, ample water ballast is provided throughout the cellular double bottom and in fore and after peaks, the former being divided longitudinally and athwartships for trimming purposes, and fitted with large tank suction pipes and extra large ballast donkey for quickly pumping out water ballast. The inside of holds, bunkers, and engine and boiler-room tanks are coated with enamel. The mooring arrangements have also received special attention, steel wire compressors being fitted on the poop and forecastle decks, as well as the usual large fairleads and bitts. Accommodation for the captain and steward is provided in the poop, the saloon being tastefully fitted up in different shades of oak. Spacious rooms for the officers and engineers are arranged at the sides of the casing under the bridge deck, the petty officers and crew being berthed in the forecastle. At the forward end of the main bridge a steel house is arranged for the captain, with lower flying bridge on top, also teak chart-house, the latter carrying the upper flying bridge. The engines, of the triple-expansion type, are by Messrs. The North-Eastern Marine Engineering Co., Ltd., Sunderland, having cylinders 21½ in., 36 in. and 59 in., with a stroke of 39 in., steam being supplied by two extra large boilers working at 180 lbs. pressure. During construction the vessel and machinery have been under the personal supervision of Messrs. Thompson & Eyres, of Sunderland.

Harmattan.—On November 30th, a steel steamer of about 4,745 tons, named Harmatian, was launched at Walker, Newcastle, the owners being Messrs. J. & C. Harrison.

Steam Trawler.—On December 1st, Messrs. Smith's Dock Company (Limited) launched from their yard at South Bank, Middlesbrough, a steel screw steam trawler, which has been built to Lloyd's highest class.

Mediterraneo.—On December 15th, this vessel, built by Messrs. Wm. Doxford & Sons, Ltd., Pallion Yard, Sunderland, to the order of the Società Anonima di Navigazione a Vapore "Lussino" of Lussinpiccolo, was launched. She has been built to Lloyd's and Austrian Veritas Class under Special Survey. She carries 7500 tons deadweight on 23½ ft. draught, and steams ten knots, being fitted with triple-expansion engines and Howden system boilers, also built by Messrs. Doxford.

Screw Steamer.—On December 16th, Messrs. Craig, Taylor and Co., Ltd., launched from their Thornaby Shipbuilding Yard, Thornaby-on-Tees, a handsomely modelled single-deck screw steamer of the following dimensions, *viz.* :—392 ft. by 52 ft. by 29 ft. 6 in. moulded. She is built of steel to the highest class in Lloyd's registry, under special survey, and has poop, bridge and topgallant forecastle; water ballast in double bottom fore and aft, and in peaks. She is equipped with patent direct steam windlass with quick warping ends, steam steering gear, eight steam winches; shifting boards in holds for carrying grain cargoes; telescopic masts to Manchester Ship Canal requirements, double derricks, and all the latest improvements for rapid loading and discharging. The accommodation for captain, spare room, and officers is neatly fitted up in deckhouses amidships, the engineers being dockhouse alongside engine casing, and the crew under the bridge. Her engines have been constructed by Messrs. MacColl & Pollock, Ltd., of the Wreath Quay Engineering Works, Sunderland, the cylinders being 25½ in., 43 in., 70 in. by 45 in., with three boilers working at 180 lbs. pressure. The vessel has been built to the order of Messrs. Henry Clapham & Co., of the Clapham Steamship Co., Ltd., Newcastle-on-Tyne, under the superintendence of Mr. Thomas Harbottle, of Newcastle. Messrs. Craig, Taylor & Co., Ltd., are about to put down the keel of a still larger vessel, which they have to build on the "Isherwood" Patent System.

Levenpool.—On December 16th, Messrs. Ropner & Sons, Ltd., Stockton-on-Tees, launched from their shipbuilding yard, a steel screw steamer of the following dimensions, *viz.* :—Length, 389 ft. 3 in.; breadth, 57 ft. 6 in.; depth 28 ft. 6 in. The vessel will be classed 100 A1 at Lloyd's, having main deck, poop, long bridge and topgallant forecastle. Accommodation for captain, officers and engineers in houses on bridge deck, crew in the forecastle. The vessel has double bottom for water ballast on the cellular principle, all fore and aft, and in fore and after peaks. She will be fully equipped with an up-to-date outfit, including quick warping windlass, stockless anchors, steam steering gear amidships and powerful screw gear aft. The appliances for loading and discharging cargoes expeditiously are very complete, and include ten steam winches, double derricks to each hatch, steam being supplied by a large donkey boiler, working at 100 lbs. pressure per square inch. The engines will be of the triple-expansion type by Messrs. Blair & Co., Ltd., Stockton-on-Tees, of about 2450 I.H.P., having three steel boilers 15 ft. 6 in. by 11 ft., 180 lbs. steam pressure.

Hull Trader.—On December 17th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw cargo steamer, the principal dimensions of which are :—127 ft. by 22 ft. 6 in. by 9 ft. 7 in. moulded. The vessel, which has been built to the order of Mr. F. W. Horlock, of Mistley, Essex, will be fitted with triple expansion engines by Messrs. Crabtree & Co., Ltd., of Great Yarmouth, and is replete with all the latest improvements for this class of vessel.

Berwindvale.—On December 15th, Messrs. Sir Raylton Dixon & Co., Ltd., launched from their Cleveland Dockyard, Middlesbrough, a fine steel screw steamer, which is believed to be one of the largest merchant colliers yet built. The vessel is being constructed for American owners on builders' latest improved patent cantilever framed system, with top-side water-ballast tanks, shelter-deck type, and to plans and specifications prepared by Messrs. William Esplen & Sons, Liverpool, in conjunction with Mr. C. H. Stapleton, manager for owners, whose special knowledge of the particular requirements of the trade for which vessel is intended has considerably assisted in designing a vessel with the best possible facilities for the rapid handling of coal cargoes. The principal dimensions of the vessel are :—425 ft. long by 54 ft. beam by 29 ft. moulded, and she will have a deadweight carrying capacity of over 8,500 tons on a light draught of water. Triple-expansion engines are placed aft, having cylinders 28, 46 and 77 inches by 48 inches stroke, supplied with steam by three large single-ended boilers fitted with Howden's system of forced draught, which are estimated to drive the vessel a speed of 11½ knots loaded, will be fitted by Messrs. Richardson Westgarth & Co., Ltd., of Hartlepool.

LAUNCHES—Scotch.

Steam Dredger No. 508.—On November 7th, a steel steam dredger of about 748 tons gross, named No. 508, was launched at Renfrew. She has been built to the order of the Canadian Government.

Barge-Loading Dredger T.C.C. No. 8.—On December 1st, there was launched at Paisley the barge-loading dredger *T.C.C. No.* 8 for the Tees Conservancy Commissioners, Middlesbrough. The dredger is of the bucket ladder type, and of special design for carrying out the improvements being made on the Tees. The vessel has been built under Lloyd's special survey.

Screw Steamer.—On December 3rd, there was launched from the shipbuilding yard of Messrs. Wm. Hamilton & Co., Ltd., Port Glasgow, a handsomely-modelled steel screw steamer, built to the order of Messrs. Gilmour & Co., Ltd., Liverpool. The principal dimensions are :—Length, 364 ft.; breadth, 50 ft.; depth, 28 ft. 2 in. to upper deck; dead-weight, 6700 tons. The vessel, which is of the single-deck type, is rigged as a fore-and-aft schooner, and has a large poop, long bridge, topgallant forecastle, and large clear holds. The vessel will be fitted with machinery by Messrs. Rowan & Co., of Glasgow.

St. Kilda.—On December 3rd, there was launched at Port Glasgow a steel screw steamer, built to the order of Messrs. Rankin, Gilmour & Co. (Limited), Liverpool. The principal dimensions are :—Length, 364 ft.; breadth, 50 ft.; depth, 28 ft. 2 in. to upper deck; deadweight, 6700 tons. The vessel, which is of the single-deck type, has a large cargo poop, long bridge, topgallant forecastle, and large clear holds. The vessel, which will be fitted with machinery at Glasgow, will have Lloyd's highest class. The steamer is built on the Isherwood longitudinal framing system.

Angora.—Recently the turbine steamer *Angora*, built for the British India Steam Navigation Company's mail and passenger service between Calcutta and Rangoon, was launched from the Leven Shipyard by Messrs. William Denny and Brothers. She is built of steel to Lloyd's highest class, and her principal dimensions are :—Length, 390 ft.; breadth, 49 ft. 11½ in.; depth (moulded), 32 ft. 6 in. The main deck, which extends from end to end of the vessel, will be entirely devoted to accommodation of native passengers, and is provided with ample light and ventilation. On the shade deck is accommodation for fifty first and fifty second-class passengers. The first-class cabins are large and well-ventilated, the berths generally being arranged in single tiers. The vessel only carries a moderate amount of cargo, being designed with fine lines so as to maintain a good speed at sea. The propelling machinery will be supplied by Messrs. Denny & Co., and is of sufficient power to give the vessel a speed of 17½ knots. The *Angora* is the ninety-seventh vessel which Messrs. Denny Brothers have built for the British India Steam Navigation Company. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel was applied to bunkers and boiler-room tank, and their "Bitumastic" covering to tank top in boiler-room.

LAUNCH—Irish.

Maloja.—On December 17th, this fine large twin-screw steamer, built by Messrs. Harland & Wolff, Ltd., for the Peninsular & Oriental S. N. Co., was successfully launched at Belfast. The *Maloja* is a passenger and mail steamer of the highest class, and the largest vessel yet built for the P. & O. Line. The launch of this vessel appropriately completed the tonnage output of Messrs. Harland & Wolff, Ltd., for the year, making up a record total of 115,861 tons and 100,130 I.H.P. The new vessel is 569 ft. long by 62 ft. 9 in. beam, with a gross tonnage of about 13,000, and in her construction and design she will represent the latest and most

approved practice. She has two steel pole masts and two funnels, ten watertight bulkheads carried up to the spar deck, seven steel decks, and the double bottom extends right fore and aft, the depth and strength being increased under the engine-room, giving great rigidity to the structure. The *Maloja* will have accommodation for over 450 first-class and about 220 second-class passengers, and the various public-rooms, also the state-rooms, will be furnished and decorated in a style well in keeping with the traditions of this famous line. The first-class dining saloon, on the spar deck, extends the full breadth of the ship, and will seat 318 people. It will be panelled and framed in British oak, and enriched with limewood carving and sycamore pilasters. The first-class smoke-room on the promenade deck, with raised roof, will be in Austrian oak, relieved with limewood carving. The first-class music-room, on the hurricane deck, will be in English oak, with carving also in limewood. The first-class divan, on the hurricane deck, is panelled and framed in English oak, the ceiling decorated plaster panels. These rooms will have large sidelights or square opening windows. The dining saloon will have a handsome decorated well overhead, as will also the music-room ; the smoke-room has a handsome skylight, and the divan two skylights. The first-class state-rooms include a number of single-berth rooms, with cot beds. Special attention has been given to the ventilation, both natural and mechanical. The second-class accommodation includes smoking-room, music-room and dining saloon, the last named extending the whole breadth of the vessel and seating about 200. The arrangements for working ship and cargo will be of the most approved type, including ten hydraulic cranes, anchor crane and steam windlass. The steering gear is of the builders' well-known make, and capable of being worked by telemotor from flying bridge. The vessel has large insulated cargo holds. She will be fitted throughout with electric light, and provided with an installation of wireless telegraphy, the Marconi house being on the Promenade deck near the officers' house, the captain's house being on the boat-deck above the officers' quarters. The *Maloja* will have two sets of quadruple-expansion engines arranged on the "balanced" principle, also constructed by Messrs. Harland & Wolff, Ltd.

TRIAL TRIPS.

Perdita.—On November 8th, the trial trip was run off Sunderland of the steamship *Perdita*, built to the order of the South Wales and Liverpool Steamship Company (Limited), of which Messrs. Robert Gilchrist & Co., of Liverpool, are the managers, for their trade between the Mersey and Bristol Channel ports. The vessel is the second built for the company at Alloa. In hull and machinery her equipment is in all respects thoroughly up-to-date. She carries 660 tons, and promises to steam 11 knots in ordinary weather. This vessel was launched on November 15th.

Maianbar.—On November 12th, the twin-screw passenger and cargo steamer *Maianbar*, built at Ardrossan for the North Coast Steam Navigation Company, Sydney (N.S.W.), ran trials on the Clyde. The vessel, which has been constructed to the British Corporation special survey and Board of Trade passenger certificate, is intended for the Sydney and Manning River trade. The machinery was supplied from Glasgow. The trials proved satisfactory, all the essential requirements of speed, carrying, and draught being fulfilled. The vessel leaves for Sydney, *via* the Suez Canal, on Thursday.

Syndic.—On November 15th, the screw steamer *Syndic*, built by the Blyth Shipbuilding and Dry Docks Co., Ltd., for Messrs. The Syndic Steamship Co., Ltd. (Messrs. Isaac B. Pearson & Co., Glasgow, managers), was taken to sea for trial. Triple-expansion engines of good power have been fitted by Messrs. The North-Eastern Marine Engineering Co., Ltd., Wallsend, cylinders 23, 38 and 62 in. by 42 in. stroke, working at 180 lbs. pressure. The representatives of owners, builders and engineers on board were highly satisfied with the performance of both ship and machinery, good results being obtained. For Launch, see November issue. A Cochran (Annan) donkey boiler, with patent seamless furnace, has been supplied and fitted.

Escrick.—On November 30th, the handsome steel screw steamer *Escrick*, which is the nineteenth vessel built by Messrs. Wm. Gray & Co., Ltd., to the order of Messrs. The London and Northern Steamship Co., Ltd. (Messrs. Pyman Brothers, London, managers), was taken to sea for her trial trip. The hull and machinery have been constructed under the superintendence of Mr. R. T. Rutherford on behalf of the owners, and that gentleman witnessed the trial trip, which was in every way satisfactory, an average speed of 11 knots being maintained. For Launch, see November issue.

Francisco.—On December 9th, the finely-modelled screw steamer *Francisco*, built by Messrs. The Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne, to the order of Messrs. Thos. Wilson, Sons & Company, Ltd., Hull, for their Atlantic trade, left the Humber to undergo her official trial trip. Triple-expansion machinery 28 in., 45½ in., 76 in. by 54 in., of special design and construction, has been supplied by Messrs. Earle's Shipbuilding and Engineering Co., Ltd., Hull, with three extra large boilers working at a pressure of 180 lbs., and fitted with Howden's system of forced draught. The trial trip proved in every way satisfactory, and a speed of 12 knots was easily obtained. Among the guests on board were the following :—Mr. R. Duguid, Mr. W. S. Hide and Captain Jones, representing the owners ; Mr. J. Graham and Mr. E. Graham, representing the shipbuilders ; and Mr. W. H. Tyacke, representing the engine builders. For Launch, see November issue.

Strathardle.—Recently the new steamer *Strathardle*, built at Dumbarton, ran trials on the Firth of Clyde. The vessel, which has been constructed to the order of Messrs. Burrell and Son, Glasgow, was engined at Glasgow. During the trial everything worked satisfactorily.

Ascanius.—On December 21st, the new twin-screw steamer *Ascanius* left Belfast Harbour, and proceeded to Carrick Roads for adjustment of compasses, after which the machinery tests, and speed trials over the measured mile course in Belfast Lough took place. These trials proved thoroughly satisfactory, the result exceeding the specified requirements. The vessel afterwards proceeded to Glasgow to load cargo, and will leave that port in the course of a few days, calling at Fishguard to take passengers on board, for the initial voyage to Australia. For particulars of Launch, see December issue.

BOARD OF TRADE EXAMINATIONS.

NOTE—1C denotes First Class : 2C Second Class.

November 10th, 1910.

Allen, A. R.	1C	N.Shields
Barclay, E. E.	2C	Liverpool
Barker, C. J.	2C	London
Corbett, J.	2C	Liverpool
Craske, C.	1C	Liverpool
Finney, E. B.	1C	London
Fleming, A. R.	1C	Greenock
Gatland, A. L.	1C	London
Guthrie, T.W.P	2C	Liverpool
Herbertson, T.	1C	Greenock
Hilling, F.	1C	Hull
Hunt, H	1C	N.Shields
Hyde, J. B.	2C	London
Lawson, F.	1C	N.Shields
Lochhead, W. S.	2C	London
M'Aulay, C. A.	2C	Liverpool
Mitchell, J.	1C	Greenock
M'Laren, R. H.	1C	N.Shields
Rankin, A. B.	1C	London
Rankin, J. A.	2C	Greenock
Roddick, W. R.	2C	London
Smythe, A. E.	2C	London

November 17th.

Alexander, H. S.	2C	Glasgow
Bonar, J. M.	1C	Leith
Byrie, A.	2C	Glasgow
Campbell, R. R.	1C	South'ton
Chappel, W. J.	1C	N.Shields
Cleave, T. C.	1C	Plymouth
Clement, O. A.	1C	Glasgow
Cox, A. J.	2C	Cardiff
Crichton, J.	2C	Glasgow
Crofton, M. P.	1C	W. Hart'l
Crumley, R	1C	Barrow
Date, H.	1C	South'ton
Davies, A. B.	2C	Cardiff
Digman, H.	1C	N.Shields
Fleming, A.	2C	Cardiff
Goding, J. W.	1C	W. Hart'l
Gregory, F. E.	2C	N.Shields
Gunston, R W.	2C	Cardiff
Holdforth, E. H	1C	W. Hart'l
Hope, W H.	1C	W. Hart'l
Hutton, R.	1C	Leith
Innes, D	1C	Leith
Kahlcke, R.G H	2C	Glasgow
Linton, H.	1C	Leith
Lochhead, A	2C	Glasgow
Love, F. E.	2C	Barrow
Martin, H. M'L	2C	Glasgow
Meares, R B.	1C	Barrow
M'Ghie, W. S	2C	N.Shields
Mitchell, W. R	2C	W. Hart'l
M'Naughton, D	1C	Glasgow
Moir, C.	2C	Liverpool
Munro, J.	2C	Glasgow
Newman, L. A.	2C	South'ton
Payne, C. A.	2C	Cardiff
Prior, L. C.	1C	South'ton
Ratcliffe, C.C.A.	2C	South'ton
Reay, T. M.	1C	N.Shields
Smith, D.	2C	Cardiff

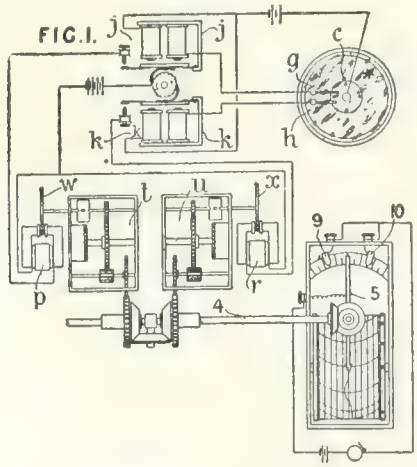
Board of Trade Examinations—*continued.*

Smithson, J. B.	2C W. Hart'l	Hulett, C. G. ..	2C London
Spawls, J. H. ..	2C W. Hart'l	Jamieson, S. F.	2C Aberdeen
Stokoe, M. B...	1C N.Shields	Johnston, W. H.	1C Liverpool
Thompson, C.O.	2C London	Kelly, T. W. ..	2C Liverpool
Thompson, J. P.	1C N Shields	Livingston, A.	1C Greenock
Tims, F. W ..	1C London	Mackenzie, C.	1C Bristol
Walker, E. R...	1C N Shields	Marshall, J.....	1C N.Shields
Walliker, A. ..	2C Cardiff	Martin, B. M...	1C Greenock
West, T.	1C W. Hart'l	Maynard, F. F.	1C London
Winn, C. A. B.	1C Cardiff	Miller, R.	2C Greenock
Woods, H.	2C Cardiff	Morrow, W. T.	1C Liverpool
		Murphy, J. B.	2C Liverpool
November 24th.		Oakes, D.....	1C Liverpool
Bate, J. S.	2C Liverpool	Parker, A. R. ..	2C Liverpool
Bentley, J. W. P.	2C Greenock	Pattinson, G E.	2C N.Shields
Brough, H. F.	2C N.Shields	Primrose, S. D.	1C Greenock
Charlton, J.....	1C Hull	Rae, J.	2C Liverpool
Ching, J. T L.	1C N.Shields	Sanderson, T.P.	1C N Shields
Cooper, G. A...	1C Aberdeen	Shand, J.....	1C N.Shields
Crighton, W. ..	2C Sunderl'd	Shevlin, P.	1C Greenock
Dart, S. J.	2C Bristol	Snowdon, W. ..	1C N.Shields
Dench, A. E ..	2C Liverpool	Stephenson, E.	2C Sunderl'd
Devonald, H. J.	2C Bristol	Stewart, J.	2C Greenock
Edwards, G. ..	1C Bristol	Taylor, W. M.	2C Londn'ry
Ekbery, J. C. ..	2C Liverpool	Thomas, A. C.	1C N.Shields
Fitzgerald, A...	1C Hull	Weir, J.	1C Liverpool
Forbes, R.	2C Sunderl'd	White, J. W. ..	1C Sunderl'd
Ford, R. W. R.	1C London	Whitehead, C.C.	1C London
Gardiner, W. C.	1C Aberdeen	Wilson, A. E...	1C N.Shields
Harris, S. M. ..	1C Greenock	Young, J.....	1C Greenock
Hobson, R.....	1C N.Shields		

The Marine Engineer and Naval Architect Patent Record.

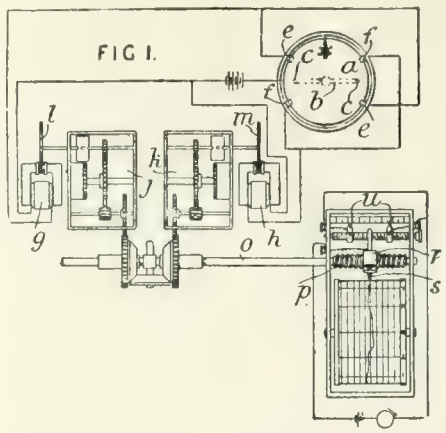
Compiled by Messrs E P Alexander & Son, Chartered Patent Agents, 306, High Holborn, London, W.C.

17,388. Ships' Course-Recorders. Should the ship deviate from its course, one of a series of points *c* on the compass card contacts with one of two terminals *g*, *h* to close the circuit of one of the two relays *j*, *k* and thus energize one of the magnets *p*, *r*, which acts on the corresponding disk *w* or *v* to cause a braking action in one of the two sets of gearing *t*,



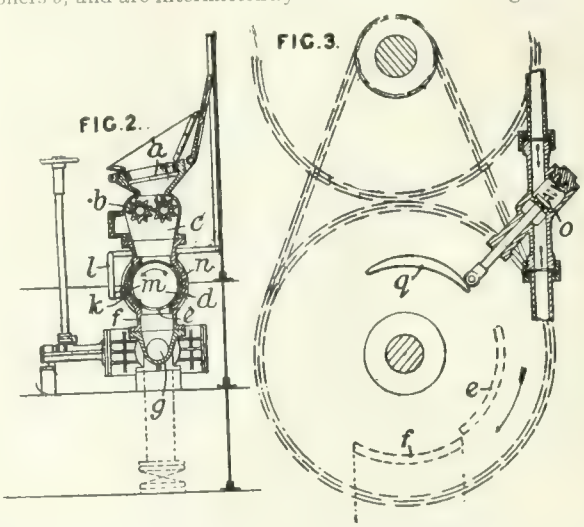
u, so that differential action takes place and the shaft 4 is positively rotated; the indicating-arm 5 therefore moves over the recording-drum, showing that deviation has taken place. If this deviation is continued for a certain time, or increases to a predetermined extent, the end of the arm 5 contacts with a stop 9 or 10 to complete circuit and give an alarm.

17,389. Ships' Course-Recorders. The compass card *a* carries a diametrical metal bar *b* with depending metal pins *c* at its ends, which, when a course is set, lie midway between metallic blocks *e*, *f* included in two circuits, equally energizing magnets *g*, *h*, a circuit being completed from the bar *b* through the liquid in the bowl. When the ship deviates from its course, the circuits become unequal and one of the disks *l*, *m*



included in two trains of clock-work gearing *j*, *k* is magnetically braked more than the other, so that the shaft *o* is positively driven in one direction or the other, and the stylus carrier *r* is traversed along the worm *p*, the stylus *s* marking the travelling record-sheet. An alarm is sounded if an arm projecting from the carrier *r* contacts with either of two stops *u*.

19,205. Ships. *Ashes, discharging.*—Relates to an apparatus for discharging ashes, etc., from ships, of the kind in which a rotating compartmental valvular device as described in Specification No. 12,605, A.D. 1904, alternately receives a charge of ashes and delivers the same to a stream of water the motion of which is due to a centrifugal pump as described in Specification No. 2326, A.D. 1908. According to the present invention, air or gas is supplied to the valvular device or the discharge pipe at a pressure sufficient to keep the water in the discharge connection from rising towards the valvular device. Ashes pass through a grating *a* to crushing-rollers *b*, and are intermittently delivered to a rotating hollow



plug *d* working in a casing *j*. The filling and discharge port *e* is alternately presented to the opening of the hopper *c* and to a discharge pipe *f*, which opens to a duct *g* through which a stream of water is maintained by a pump. Compressed air is delivered to the interior of the plug from a pipe *l* and a port *k* through a port *m*, which is arranged in advance of the discharge port *e*. After the charge of ashes and compressed air has been delivered, the exhaust is carried off through a port *n*. In a modification, the compressed-air supply is connected to the discharge pipe *f*. In this case, the air supply is regulated by a spring-controlled valve *o*, which is opened during every revolution of the plug by a cam *q* on a gear wheel.

The Marine Engineer

And Naval Architect.

LONDON, FEBRUARY, 1911.

THE DECLARATION OF LONDON

IT is seldom that a subject which is at the same time of National importance and of interest to the British mercantile world, has aroused such widespread and deep interest in a short time as has what is called the "Declaration of London." In view of the distribution of this Journal to all parts of the civilized world, we venture to think it will be a matter of considerable interest to our readers to have information on the matter, both as to what the "Declaration of London" is, and the views of those deeply interested in shipping matters in this country. It will be remembered that in 1907 at the Hague Conference the question of setting up an International Prize Court was dealt with, and the "Declaration of London" is a compilation of rules drawn up by the representatives of the ten leading Naval Powers, who, at the close of 1908, met in London on an invitation given by the British Government. The purpose, therefore, of the Declaration is to provide the International Prize Court with a system of law on which it can regulate its proceedings and the Declaration embodying the rules was signed in the early part of 1909. As in all matters of this kind as far as our own country is concerned, in order to give practical effect to the proposal, it is necessary that an Act of Parliament should be passed which will at once abolish the independence of the old and time-honoured British Prize Court and set up a new court altogether. This new court is to consist of fifteen judges, of whom only one is British, while countries such as the Netherlands, Norway, Greece, Argentine and Columbia are entitled also to one judge apiece. The legislative provisions for effecting the change are contained in the Naval Prize Bill, which the Government introduced in the last Parliament, and which it is intended shall be debated during February on the re-assembling of the House of Commons. Judging from the resolutions that have been passed all over the country by Chambers of Commerce and the various shipping associations, the dangers of the proposal are fully appreciated, and it is clearly recognised that if the Naval Prize Bill becomes an Act of Parliament, so that the "Declaration of London" is ratified, serious harm will be done, as it is firmly believed that His Majesty's Navy will be placed at a most serious disadvantage in any future war in which it may be involved. The main objection may be summed up in the words "National Starvation" and the grounds upon which this view is based are well set out in the views expressed by some of the Chambers of Commerce. It is held that the Declaration has been framed without sufficient regard to the fundamental difference between the situation of Great Britain and that of continental countries. It must be remembered that Great Britain produces only about one-fifth of the wheat she consumes, and consequently has to rely for the remaining four-fifths upon sea transport, as well as for a large proportion of the other necessaries of life. Foreign states are to a large extent self-supporting, and are in the position of being able to make up any food deficiency either from adjoining states or by land conveyance from neutral ports. To make the matter clear we will now refer to the language of Article 34, which appears to be the one to which so much objection is offered, and it will be admitted that the language is decidedly ambiguous, particularly on the ground that the presumption of "Hostile Destination" is raised:—By Article 34 if the goods are consigned (a) to enemy authorities; or (b) to a contractor established in the enemy country who as a matter of common knowledge, supplies articles of this kind to the enemy; (c) to a fortified place; or (d) other place serving as a base for the armed forces of the enemy, they are contraband of war.

Explanations have been given on questions raised on this clause by Sir Edward Grey, the Secretary of Foreign Affairs, and it would appear that on the one hand, either the critics are labouring under serious misapprehension as to the effect of the Declaration, or on the other hand, the Foreign Secretary himself must be labouring under a serious misapprehension as to what the real interests of the traders in this country are. When matters are being discussed from theoretical and practical standpoints, the average man in considering trade matters usually takes the practical side rather than the theoretical, whatever apparent advantages may appear on the face of the theory. So much of the criticism has been concentrated on the matter of food supply in the time of war, that a perusal of the report of the Royal Commission on Food Supplies is distinctly useful in investigating the wide possibilities of a food panic in this country in the event of Great Britain being engaged in a war involving our home waters. Mr. Douglas Owen, in a paper read last month before the Royal United Service Institution, dealt with the subject in a very comprehensive manner. He pointed out that if the Declaration of London becomes law our enemy would have an altogether new and deadly weapon to use against us, namely, the cutting off of our food supplies. By carefully choosing his time, his fast cruisers and converted mail steamers would advertise their presence off the ports from which corn is shipped to us and on the trade routes which such shipments follow, resulting in a general panic, and one among shippers particularly. In this way trade would be brought to a standstill and the duration of the stoppage would depend upon the effectiveness of our patrol and preventative measures, which in itself is an all important matter.

The Glasgow Shipowners' Association point out very forcibly that the position of this country differs so materially from that of the other signatory powers, as almost to create a presumption that what may be beneficial to them must be prejudicial to us. There is no doubt that the Glasgow people have a fear that the estuary of the Clyde may be held to be in itself a base as defined under section *d* of article 34, quite apart from the fact, that there is a railway connection between Glasgow and the naval base upon the Forth. Hitherto it has always been contended by the Authorities here that food carried in a neutral ship is never liable to seizure when it is not being directly transported to a hostile fleet or a beleaguered fortress. It would seem, however, to be clear from the wording of article 34, that it can be properly seized when it is consigned to the enemy's authorities, to a trader in the enemy's country, to a place which is fortified or to a place which serves as a base of the forces of the enemy. If this article means anything, it means that the permission is granted to seize, during war, food consigned to any British port of any size. It has been contended in the past that there is reasonable ground for saying that the intervention of powerful neutral powers would be made, should such a thing occur, as for example, the sinking of neutral ships carrying food to England by the action of German warships. Under the Declaration, however, this could not legally take place, as the hands of such neutrals would be tied in advance. To show the disparity thus created, it is obvious that the importation of food to Germany would remain absolutely secure, for it need only be shipped through a Belgian or Dutch port and could not be then interfered with. The subject requires to be examined from a broad standpoint, and although there may be weak features in the Declaration it must be acknowledged that there are certain distinct advantages. Among these we may point to the inclusion of the list of materials which are to be free, *viz.*:—the raw materials utilized in nearly every one of our great national industries. It appears to be clear that in no possible circumstance can these materials be declared contraband under the Declaration. This feature has been emphasized by the Liverpool Steamship Owners' Association, who support the Declaration, as it is considered by them to be a distinct gain, for in their view, the Declaration, while fully upholding the belligerents, establishes a code to take the place of more or less indefinite usages which have hitherto given rise to so much doubt and controversy. Still the main ground of objection remains and is strongly sympathised with by our Australian Colonials, who propose to submit at the coming Imperial Conference the rejection of Articles 48 to 54, and the omission of food stuffs from Article 34. It is to be hoped that the House of Commons will not commit the country to any definite action under the Naval Prize Bill, to which the Declaration is ancillary, until after the Imperial Conference is over, when the discussion in the House of Commons can be carried out with a more satisfactory conclusion than would otherwise be the case. It seems to us to be of the utmost importance that the reasons drafted by the London Chamber of Commerce should receive the most careful attention of His Majesty's advisers before any irrevocable action is taken. These reasons are so well set out that we give them hereunder in full:—

1st. That the effect of the Declaration is to alter the law of nations as hitherto maintained in a manner entirely unprecedented, and to expose to capture or deliberate destruction food supplies borne to any port of Great Britain in neutral vessels.

2nd. That the absence of any provision in the Declaration for preventing the conversion of merchant vessels into commerce destroyers on the high sea, constitutes a valid reason for praying His Majesty's Government to decline to ratify the Declaration or to proceed with the Naval Prize Bill.

3rd. That the admission of the principle of destruction of neutral prizes would be in the highest degree prejudicial to the interests of this country.

Just before going to press an announcement has been made that the Government have decided to postpone the discussion of the Naval Prize Bill until after the meeting of the Imperial Conference, which is to take place in the summer.

The Government are very wise and to be congratulated on taking the only really practical course after the wide expression of public opinion, not only at home, but from the Dominions. At the same time it is a distinct change of front, as so late as November 19th last the Ministry stated in Parliament that it was impracticable to consult the Dominions on the matter.

NAVAL CONTRACTS.

IN accordance with the promise made when the Estimates were presented, the Admiralty have now placed contracts for the building of all the fighting ships in the programme of the financial year, 1910-11. Two out of the five armoured ships, and three of the five protected cruisers, were allotted for construction to the public dockyards. The former ships are the *King George V.* and *Centurion*, which were officially begun at Portsmouth and Devonport on January 16th; while the cruisers are the *Active*, which has been in hand for some time at Pembroke; the *Amphion*, which will succeed the *Active* on the slip next month, and the *Chatham*, the keel plate of which was laid at Chatham Dockyard on January 3rd. The vessels to be built by private firms comprise the battleships *Ajax*, for which the Scott's Shipbuilding Co. have secured the contract, and *Audacious*, which will be constructed by Messrs. Cammell, Laird & Co., with a large armoured cruiser, ordered from the

Palmer's Shipbuilding Co. The two contract-built cruisers in the programme will be called the *Dublin* and *Southampton*, and they will be constructed by Messrs. Beardmore & Co. and Messrs. Cammell, Laird and Co. Contracts for the destroyers in the estimates were signed last summer, while the submarines as usual will be divided between Messrs. Vickers, Sons and Maxim, and Chatham Dockyard. A special feature of the programme was the number of auxiliary craft which it contained. These included a submarine depot ship, which the Scott's Shipbuilding Co. are to construct, two submarine tenders, to be built by Messrs Cammell, Laird & Co., a salvage steamer, intended especially for use with submarines, which has been ordered from the Vickers firm, and a coastguard cruiser, surveying vessel and two additional floating docks.

The work represented by these contracts is considerable in volume and important in character. The 1910-11 programme was not such a heavy one as that of 1909-10, as it contained five instead of eight armoured ships, and five cruisers instead of six. But taking into consideration the warships ordered for the Colonial Governments during the past twelve months, and also the number of auxiliary vessels to be built, it will be found that the tonnage of new construction begun during the present financial year quite equals that of the naval work put in hand in 1909-10. At the present time, there are fifteen armoured ships, twelve protected and unarmoured cruisers, forty-three torpedo boat destroyers and a number of submarines building or ordered to be built for the British Empire. Taking only vessels of the largest class, there has never been such a large number in hand at one time since the period for the building and completion of an armoured ship was fixed at two years. That the amount of work involved in these heavy programmes of the last two years can be undertaken without putting any strain upon the private shipbuilders and manufacturers of war material—which are even able to accept foreign contracts, as the Japanese cruiser building at the Vickers yard shows—is a striking testimony to the resources and capacity of Great Britain in this direction. It is noteworthy in this connection also that of the four British concerns which are now capable of supplying all the component parts of a battleship without going outside their own establishments, *viz.*, Messrs Vickers, Sons & Maxim, Messrs Armstrong, Whitworth and Co., Messrs Beardmore & Co., and the firms in the Coventry combination,—only Messrs Cammell, Laird and Co. of the last-named group, have received an order for an armoured vessel of the 1910-11 programme. The two other firms associated with the Coventry Ordnance Works are each constructing a Colonial "Dreadnought," while the firms of Armstrong, Vickers and Beardmore each have a battleship of the 1909-10 programme. Messrs Cammell, Laird & Co. are now constructing a battleship of the "Dreadnought" type for the first time, and their entry into the lists brings up the number of British firms who have built or are building "Dreadnoughts" to nine.

THE WORSHIPFUL COMPANY OF SHIPWRIGHTS. The Master, Professor J. H. Biles, LL.D., the well-known occupant of the chair of Naval Architecture at the Glasgow University, entertained the members of the Court of Assistants of the Company and some friends to dinner at the Grand Hotel, Trafalgar Square, on January 23rd. Among those present were Dr. Clement Godson, M.D., V.D., 1st Warden; Mr. J. Bell White, 2nd Warden; The Right Hon. Sir Edward Clarke, K.C., P.C., 3rd Warden; Alderman Sir William H. Dunn, 4th Warden; Lord Brassey, Pastmaster; Rear Admiral Tupper, Sir William H. White, K.C.B., F.R.S., Sir Philip Watts, K.C.B., F.R.S., Director of Naval Construction; Mr. Hugh Drummond, Chairman of the London and South Western Railway; Alderman Sir Joseph Savory, Bart., Pastmaster; Mr. J. H. Narbeth, M.V.O., Mr. Archibald Denny, Mr. James Denny, Mr. Stanley Keith, the Master of the Worshipful Company of Skinners; Mr. H. W. S. Baden-Powell, K.C., The Hon. T. A. Brassey, Lieut. J. Hay, R.N., Mr. J. McKechnie, Mr. R. R. Bevis, Mr. Thomas Bell, Col. J. Saxton White, the Rev. A. R. Clemens, Chaplain; Mr. A. J. Fells, Mr. J. Wrench Towse, Col. T. Davies Sewell, F.R.A.S., Treasurer; Mr. Harry Brittain, Mr. E. P. Clarke, Mr. J. H. Biles, junr., and Mr. H. W. Sewell, Acting Clerk. Lord Pirrie and Mr. H. T. Bailey, Pastmaster, had attended the Court in the afternoon, but were unable to stop to the dinner. The Master, in proposing the toast of the new members of the Court who had been elected at the meeting held earlier in the day, said, that it was with great pleasure he had to announce that Mr. Hugh Drummond had been elected to fill the vacancy caused by the death of Sir Charles Scotter, who had for so many years been a prominent and indefatigable member of the Court and a Pastmaster. The Hon. Charles A. Parsons was another member elected, whose fame was world-wide, and whose name would go down to posterity and be bracketed with that of James Watt in the history of marine propulsion, while the third new member elected was Mr. Charles E. Ellis, Managing Director of that well-known firm, Messrs. John Brown & Co., Ltd., who had so large an interest in British Shipping. Mr. Hugh Drummond in responding said, that he was proud to be elected as a member of the Court of this ancient Guild, the Craft it represented being one of the oldest in the world. Lieut.-Col. the Hon. T. A. Brassey proposed the health of Sir Philip Watts, who had that day been elected 4th Warden, and who would be admitted to office at the next Court on the retirement of the present Master. The Master proposed the toast of the new Livery, coupling with it the names of Mr. R. R. Bevis, Mr. J. McKechnie, and Mr. Thos. Bell, these gentlemen having been formally admitted to the Livery by the Court that day. Sir Joseph Savory, Bart., Pastmaster, proposed the health of the Master and alluded to the splendid work done for the Company during his year of office. The toast was received with enthusiasm. The Right Hon. Sir Edward Clarke, K.C., proposed the health of Lord Brassey, to which his Lordship suitably responded. At the Court meeting previously mentioned, among other business transacted, grants were made to the Educational Trust Fund of the Company, which provides scholarships and prizes to the students of Naval Architecture at various educational centres throughout the United Kingdom, also to the Pension Fund for assisting the Widows of Freemen and Liverymen of the Company.

THE gold emblem of New Zealand has been awarded by the Australasian Institute of Marine Engineers to Mr. F. Reddaway, of Pendleton, Manchester, who has also been elected a Hon. associate of the Institute in recognition of his kind liberality in presenting for the entrance hall of the new building erected at Wellington, a bronze figure which has been much admired and appreciated by the members. The presentation is to be made by Sir Wm. Hall Jones, High Commissioner of New Zealand, and arrangements are in hand to make the presentation at the premises of the Institute of Marine Engineers, 58, Romford Road, Stratford, on Friday, February 17th, on the occasion of one of the popular Bohemian concerts.

COMBINED COOLING AND SCAVENGING SYSTEM FOR FOUR-STROKE CYCLE INTERNAL COMBUSTION ENGINES.

THE method of scavenging the cylinders of gas engines by the aid of compressed air, after the combustion stroke, is receiving increased attention owing to the very satisfactory results obtained. These are largely due to some cooling brought about by the scavenging air, although the object of scavenging, as now in use, is mainly to remove the combustion products and to improve the fresh charge. Such simple requirements are fairly well satisfied by blowing air into the cylinder from any convenient spot.

The system to be now described is the invention of Mr. J. J. Ruckstuhl, of 10A, High Street, Stockport, and is mainly intended for cooling the working parts, but affords at the same time all the advantages of scavenging in an improved manner and to an increased degree.

The principle can be better gathered by reference to Fig. 1 of the adjoining diagrams, where *a* is the engine piston, *b* a hollow rod starting from the head of the piston and ending in an air piston *c*, which works in the air cylinder *d*. The pump cylinder is supported by the frame of the engine in any suitable manner.

In Fig. 1 the piston is at the end of the compression stroke, on the following explosion stroke the air piston or plunger draws a charge of air into the pump cylinder through an inlet valve provided at *e*. On the exhaust stroke the contents of the pump cylinder are forced through the hollow plunger to a delivery valve provided at the head of the piston, and thence into the engine cylinder. The cooling action is terminated at the completion of the exhaust stroke.

The inlet valve on the engine piston may be automatic, but as its actuation does not involve any more complication than a valve on the engine, it is preferable to operate it mechanically. If the valve is automatic, it is opened by the air pressure and closed by the tension of its spring, eventually assisted by the weight of the valve.

The engine piston which was left cooled at the end of the exhaust stroke will now complete a cycle with the compression and combustion strokes. As no air should be supplied into the cylinder during this time, the air inlet valve must remain open, whereby the pump is put out of action. It would be convenient to control this valve from the half-speed shaft. However, idle strokes of the pump must be avoided, and the arrangement shown in Fig. 3 is one method to this end.

Fig. 3 shows two engines so arranged that the exhaust stroke in one coincides with the compression stroke in the other. These two engines actuate a common pump by two hollow plunger stems, each of which is fastened to an engine piston. The contents of the pump cylinder are delivered at every in-stroke to the piston, which is on the exhaust stroke. Should it be necessary, the pump cylinder could be conveniently made of larger capacity than one engine cylinder, for instance, if the pump had double the capacity of an engine, its diameter would only increase by about one-third.

From the above arrangement it can be seen that by connecting the single air cylinders of any two engines (working in unison like the above pair) the total contents of both separate air pumps are alternately fed into the engine cylinder when the piston is on the exhaust stroke.

The air pump may also be combined with the piston rod in such a manner that the plunger fitted to the outer end of the piston rod serves as a crosshead for the connecting rod.

In a further variation the air is drawn in the outer chamber, then forced (during an out-stroke of the piston) through a valve provided in the plunger, into the inner chamber. As this latter is smaller in capacity by the volume displaced by the plunger stems, the air is under slight pressure at the commencement of the exhaust stroke.

The mode of distributing or spraying the air in the engine cylinder is of considerable importance for the cooling efficiency of a given volume of air. The cooling effect would be least if the air was simply blown in the middle of the cylinder. To bring about sufficient cooling, such an inefficient distribution would require a comparatively large volume of air. It is desirable to obtain the required cooling effect with a small volume of air, as the size of the pump and the power it absorbs will be accordingly small. To this end the air should be brought in close and uniform contact with the heated particles of the inside face of the cylinder. The volume of air necessary may also be adjusted by imparting to it a smaller or greater amount of moisture.

If the air enters behind a valve of the mushroom pattern, it will be readily deflected on to the walls; the shape of the valve and the seating may be somewhat corrected to suit these conditions. An annular deflector, as shown in Fig. 3, may be added, but it is not certain whether the result will be improved. Another spraying arrangement is shown in Fig. 2, where the inlet valve is enlarged to form a shield covering almost the whole cross area of the piston. In a further most efficient variation the air is forced through boxes or tubes radiating from a central position and ending near the periphery of the piston. In this arrangement an annular valve may serve as deflector.

The first question to be considered now is, "Will the system described ensure proper working conditions, that is, will it adequately lower the inside surface temperature, after the combustion stroke and maintain a low level until the next combustion takes place?"

The surface of the walls of the combustion chamber and of the adjacent parts will have acquired during combustion a temperature of from 2000° to 3000° F. This surface temperature gradually falls during the expansion, because part of the heat is transferred to the body of the metal and part is returned to the expanding gases. Evidently the surface temperature of the metal cannot differ much from that of the gases with which it is in contact. At completed expansion the front section of the cylinder will have a surface temperature somewhat above, and the rear section one below the temperature of the expanded gases. At the same time the metal forming the front part of the cylinder may be more heated in the body than on the inside surface, whilst the reverse will be the case with the metal forming the rear section. It follows that the cooling action must be particularly rapid in the front part of the cylinder, where it may be necessary to cool the body of the metal to a certain depth.

When the exhaust port is opened the cooling action begins first with the reduction of the surface temperature of the metal resulting from the reduced pressure. At about the same time or little later fresh air enters from the piston; the temperature should now be reduced sufficiently to prevent it from again rising above 700° F., the flash point for lubricating oil, until the next combustion takes place.

The air, as it issues from the piston, is sprayed evenly on all areas swept by the piston (except the extreme rear areas) and every particle of the cylinder working face is thereby cooled by an equal volume of fresh air. The air takes up naturally heat during its whole passage through the cylinder; the volume of air entering during the early part of the stroke takes up heat from a larger area and during a longer time than the air entering towards the end of the stroke. The front areas of the cylinder are thereby cooled in the first instance by currents of air which have already acquired some heat, and these parts are thus prepared for subsequent direct cooling with their partial volume of fresh air. The cooling effect increases gradually in intensity from the rear end to the front end in the cylinder, at about the same rate as the need for cooling increases.

If the cooling air is at 60°F. the surface temperature of the metal will be reduced to about 100° or 200°F.; the effect, however, is only momentary, especially where the body of the metal is overheated, and as soon as the cool air is removed, the temperature on the surface will again be raised by the heat returning from the inner strata of metal, but the temperature cannot obviously reach the same level as it was before cooling, because part of the heat is removed. In addition the relatively cool piston makes contact with the cylinder face and deposits a film of lubricating oil. Nevertheless, the quantity of heat absorbed by the cold air should be such that the return flow of heat does not produce an excessive temperature on the working face, before the piston on its suction stroke again uncovers it to the cooling action of the fresh charge. The danger of overheating after the cooling stroke would probably be confined to the areas immediately adjacent to the combustion chamber. There areas, however, are uncovered to the cooling action of the fresh charge almost immediately after the cooling stroke. The fresh charge has an appreciable cooling efficiency, because it consists of part

of the air used for cooling at, perhaps, 200°F., and the fresh combustible mixture at about 60°F. The temperature of this charge being considerably lower than that of a charge consisting partly of combustion products, considerable after-cooling may be obtained. Any heat absorbed now adds to

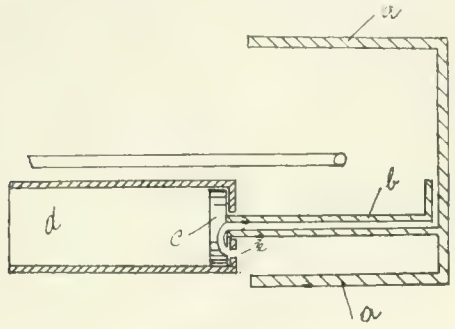


Fig. 1.

the energy of the next combustion. The proper surface temperature is obtained without thoroughly cooling down the metal, as is the case in a water-cooled engine. In spite of this the danger of overheated walls is avoided, as during about $2\frac{1}{2}$ strokes (half the exhaust and the whole suction and compression strokes) the clearance space is filled with air or gas at a low temperature, whilst the period of excessive heat only occupies the time of about $\frac{1}{4}$-stroke or $\frac{1}{16}$th of a complete cycle.

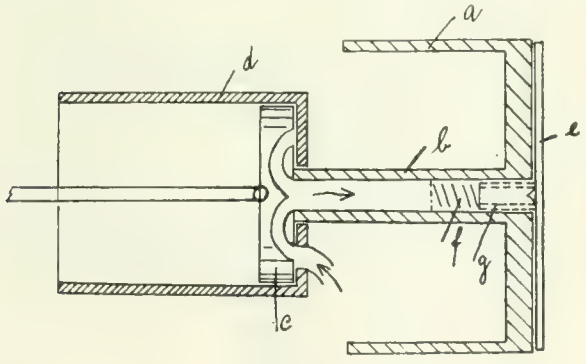


Fig. 2.

The volume of air required for cooling will depend to a very large extent on its condition. For low combustion temperatures a volume of atmospheric air equal to the capacity of the engine cylinder will probably be quite ample. For severe heat conditions the air may be saturated with moisture by simple means, whereby its cooling efficiency can be increased from four to six times.

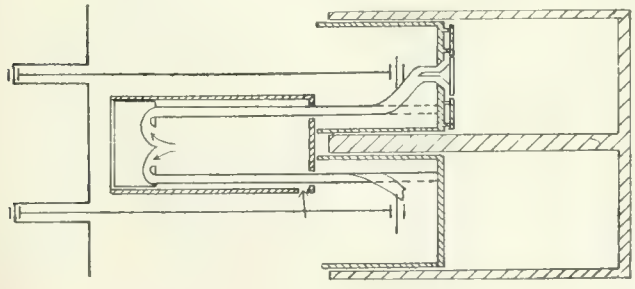


Fig. 3.

The cooling action can be improved considerably by opening the exhaust port about one-eighth before the end of the exhaust stroke, whereby the pressure is already reduced to atmospheric pressure when the cooling action begins. In addition a volume of air compressed in the outer pump chamber may be blown in the cylinder near the end of the exhaust stroke. The latter expedient is only recommended where it is not convenient to moisten the air.

Next in importance is the question of what advantages the system under discussion affords to balance the greater complication in the working parts involved by its application.

The most obvious advantage is that of a saving in fuel, or increased thermal efficiency, due to the small quantity of heat wasted for cooling purposes. Another advantage is increased power for a given size of engine.

The cooling action begins after completed expansion, at a moment when the actual heat cycle is completed and about three-quarters of the heat of combustion is already disposed of as power and exhaust loss. At the worst this cooling system can, therefore, only waste the remaining 25 per cent. which is contained in the metal. Of this remaining quantity of heat the air will hardly abstract more than 20 per cent., probably less, so that the cooling air only wastes 5 per cent. of the total heat of combustion. The remaining 20 per cent. is contained permanently in the metal and disables it to take up much heat during combustion. As has already been mentioned, the walls impart also some heat to the fresh charge, but this reappears in the next cycle.

A water jacket wastes anything from 30 to 40 per cent. and upwards of the total heat; it is of little consequence whether this value is lower or higher, because the exhaust loss varies accordingly, and the thermal efficiency and power are not greatly altered. The efficiency of a good water-cooled engine is about 25 per cent., no matter how the heat loss is divided between the water and the exhaust.

The accompanying table may give an idea how considerably power and thermal efficiency increase if the heat losses are reduced.

	Heat value.	Exhaust losses.	Cooling losses.	I.H.P.	Thermal efficiency
Water-cooled					
1	100 parts	35 parts	40 parts	25 parts	25%
Air-cooled					
2	100 ,,	35 ,,	5 ,,	60 ,,	60%
3	90 ,,	35 ,,	5 ,,	50 ,,	55½%
4	80 ,,	35 ,,	5 ,,	40 ,,	50%
5	75 ,,	35 ,,	5 ,,	35 ,,	47%
6	66 ,,	35 ,,	5 ,,	26 ,,	40%
7	60 ,,	55 ,,	5 ,,	20 ,,	33%
8	55 ,,	35 ,,	5 ,,	15 ,,	27%
9	50 ,,	35 ,,	5 ,,	10 ,,	20%

The first example shows the distribution of the heat due to a combustible mixture of 100 parts in an average water-cooled engine; 35 parts are lost in the exhaust, 40 parts for cooling and the remaining 25 parts are accounted for by the indicated horse power.

The examples 2 to 9 give the equivalent values of I.H.P. and efficiency for mixtures varying in strength from 100 to 50 parts, burnt in an internally cooled engine in which the cooling losses are assumed to remain constant with 5 parts, and the exhaust losses constant with 35 parts of the total heat. As the cooling losses will not vary to an appreciable extent here (because the cooling action begins after completion of the heat cycle), the constant value of 5 parts has been taken for simplicity.

In example 2 the power is that due to 60 parts of the total heat which brings the thermal efficiency up to 60 per cent. as against 25 per cent. obtained for the same charge in the water-cooled engine.

In example 4 the charge is reduced by 20 parts or 20 per cent., and the power accordingly falls by the heat energy due to 20 parts; the I.H.P. is therefore reduced to the value resulting from 40 parts, which gives a thermal efficiency of 50 per cent. Although the theoretical maximum temperature is here lower by 20 per cent. than in example 1, the thermal efficiency is still double that of the water-cooled engine.

Even if the charge is reduced to 66 parts, two-thirds of the original strength, the power is still above that of the water-cooled engine, whilst the thermal efficiency (40 per cent.) is still 70 per cent. higher than the thermal efficiency of the water-cooled engine.

The above figures show clearly what splendid results are obtained by reducing the heat losses to a small quantity, This fact is not generally realized to the full extent, and in the endeavours to obtain high combustion temperature the increasing heat losses for cooling purposes are often lost sight of.

In the above figures no account has been taken of the degree of compression, clearance space, and the initial volume of the charge. More advantage can be taken of these factors in an efficiently cooled engine, and the results may still be improved for internally cooled engines, more particularly if weaker charges are used. There will also be some external heat losses whereby the average of 5 per cent. assumed for cooling will slightly increase. On the other hand, better heat conditions can be maintained on the working parts of air-cooled engines whereby the co-efficient of friction is reduced. Corrections must also be made for the power absorbed by the air pump; it must, however, be noted that one pump serves for two engines, so that one engine has only to bear half the power absorbed by the pump.

It might appear convenient to assist the internal cooling action by outside air-cooling. This is hardly advisable, as a considerable quantity of heat will thereby be wasted with a small increase in the cooling effect, and it must be borne in mind that the heat energy thus lost must be made good by producing an equally higher quantity of heat in the cylinder, whereby again the heat conditions on the working parts become more severe and the requirements for cooling are increased.

Although the cooling system under discussion involves the complication of a pump and a valve on the piston it presents no mechanical difficulties. To a considerable extent the sacrifice in simplicity is already compensated for by the elimination of the water jacket and water-cooling accessories, with a considerable decrease in the weight and space occupied. The water jacket is, of course, also a complication, but it is now so well established that its drawbacks are hardly realized.

In our March issue we shall describe a new system of internal cooling for internal combustion engines.

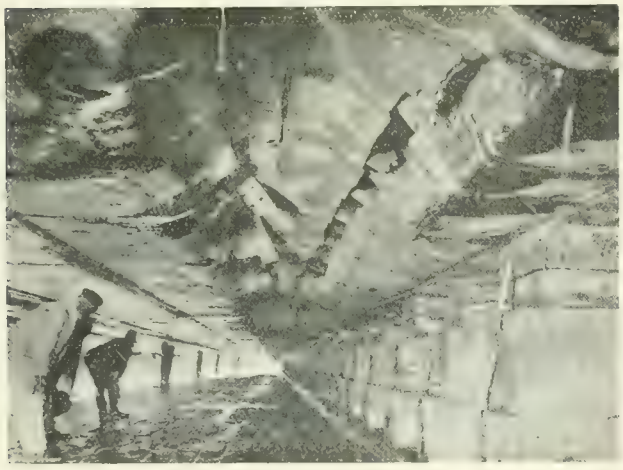
OIL-ENGINED BOATS.

THE success which attended the exhibition of motors and motor boats last year at Yarmouth has led the promoters to consider and resolve upon the question of having another this year, and at a meeting recently held it was decided to proceed with the necessary arrangements, and have an exhibition at Newcastle, and in order to widen the area for inspection and show the boats at work under test, it was proposed to have reliability trials of about 100 hours round the coast, calling at fishing ports on the east coast, so that those interested might have an opportunity of seeing what can be done, and at the same time give engine boat builders the advantage of showing the great progress made in the industry and the present state of their best and most suitable boats, whether for fishing, commerce, or pleasure. We wish the promoters and intending exhibitors all success. While those concerned in Britain are looking forward to the Tyne Exhibition, attention is also directed to the proposed races in the Mediterranean along the coast of Italy, with oil-engined boats, and we hope and expect that a British engined boat will not only compete but give a good account of herself and prove the efficiency of the machinery now in course of construction by a well-known firm in the North. There are already several British entries among the list of over fifty in number, embracing nine or ten Nationalities. We note that Messrs. Richardsons, Westgarth & Co. have entered the field as builders of marine oil engines, while other firms of high standing are about to follow suit, tokens that the internal combustion engine is establishing itself in the marine world. In the coastal commercial service the *Vixen* appears to be doing satisfactory work. She was fitted by Messrs. Croucher, Newport, Isle of Wight, in January, 1910, and has been running regularly since. She carries 60 tons of cargo, and the driving power is by means of a paraffin engine, the fuel for which is said to average in cost slightly over £5 per month. Another vessel of the fleet of which the *Vixen* is a unit is now being fitted with similar engines of the two cycle type. The cost of upkeep and running expenses of this class of engine is not much in excess of such for sails and the gear and labour, while the manifest handiness and independence of the motor over sail power give it an enormous advantage in the race for success in the coastal traffic. The firm on the Clyde at Dalmuir, which has done good and efficient experimental pioneer work in connection with the internal combustion engine, is now beginning to reap a well-earned advantage from its enterprise, and now Messrs. Beardmore have on hand, well advanced towards completion and ready for testing, four sets each of 60 B.H.P. crude oil engines, built to the order of the Tampico Navigation Co., Mexico. These engines are designed to use a very heavy class of fuel oil, and are expected to show very economical results on the service for which they are intended. The engine builders have under consideration the manufacture of large powered engines of the same class and type as these referred to, and after the tests have been satisfactorily completed, it is expected that a great advance will be made in the size and power of future engines using paraffin. The tests arranged for will be carefully watched, and the results noted, with a view to improve in every possible direction the machinery which Messrs. Beardmore have under construction, so that they can place on the market the best and most reliable marine type oil engine. It is one of the signs of progress in public favour that there are at present many enquiries for heavy oil engines for barges and for coastal service boats, trading and fishing. The question of deck gear or handling cargo and other purposes is forcing itself on the attention of prospective owners and builders of such boats, and here there is a good field for investigation and for the designer who can work out a system of power for deck service, warping, hauling and lifting winches or other machines without the aid of steam. The use of compressed air has its disadvantages, but these may be overcome, and its advantages become the important factor in determining its adoption for the purposes for which steam is at present employed. Electrical power offers itself as a competitor, and in connection with it there are also disadvantages to overcome. Both systems are worth discussing and elaborating to unfold the best and the worst points of each.

PORT JURISDICTION AND SOLICITUDE.

THE tendency of many newly constituted authorities, self-constituted and otherwise, is in the direction of seeking to coerce those who come within their sway into a channel which they conceive to be good for all, but frequently they overlook the rights and privileges of others who may happen to have a wider horizon than that comprised within their own narrow limits. The laws of a civilized country are framed to protect its citizens and prevent wanton destruction of property; the manners and customs of a courteous people are usually of a nature to encourage desirable residents or visitors, and so treat them that they may carry away pleasant memories and a desire to call again. Beside such laws and customs exists the instinct of self-preservation and advancement, whence spring regulations for the exclusion of exotic undesirables and of goods which could be made within the area of the country, even at greatly enhanced cost. Beyond these again may arise opinions and rules under which visitors are debarred under penalties from using their own property in their own way within certain coast limits, and here we have elements which may not only cause undue friction, but produce retaliation and close the door to the *entente cordiale*, save a flexible one of which we are not without knowledge. A restrictive policy tends to restriction, and may end in an absurdity, as well as defeat the ends originally aimed at. How far it is desirable to restrain the individual is debatable ground. Recent events have proved that homicidal maniacs should not be allowed at large; would-be suicides are allowed more latitude, while there are many travellers and pioneers, experimenters, testers and others who risk their lives freely for the advancement of science or their own gain without let

or hindrance. Such thoughts have been induced by the peculiar circumstances which have been narrated to us regarding a vessel which formerly hailed from Britain. The *Papanui*, in the course of a voyage from London to New Zealand, met with a disaster on the coast of Australia, resulting in her shell plates being ripped for a considerable distance. The damage may be approximately estimated from the illustration reproduced. The owners after mature consideration decided to dispose of the vessel rather than repair her and make good the damage under all the conditions involved in a wide view of the situation. The vessel was sold, and the agents, acting on behalf of the new owner, on submitting estimates for repairs, found that these were considered to be very much greater than was warranted in the circumstances, and that temporary repairs sufficient to make the vessel seaworthy for a voyage to the Straits Settlements would prove a less costly alternative. Accordingly this was decided on, and on it becoming known, the views and



S.S. *Papanui*.

View of ship's bottom looking from amidships, forward on port side. Total length of rent, 350 feet.

opinions, the rules and regulations of the locality were brought to bear upon the question of permitting the vessel to leave the coast. The plea of unseaworthiness was advanced to the port authorities, the shipping master was appealed to, and threats of fine, police and of armed intervention were issued. On the other hand the necessary fees had been paid, and as the port authorities were unable to move to stop the ship legally, the shipping master had no legal power in the matter, as the ship hoisted the foreign flag of the new owner, an unnamed resident, and the consul had the authority to sign on the crew on board; the plea of unseaworthiness was met by the statement that two surveyors had given reports which satisfied the owner and his agents, while the Captain made known his willingness and intention of sailing, the officers and crew being all ready to go with the ship. In the teeth of opposition the vessel sailed, and the talk of the town disappeared from the gaze of those interested to pursue the course mapped out for her, thus ending an episode which may be profitable for contemplative study, and an illustration of a well-known proverbial axiom.

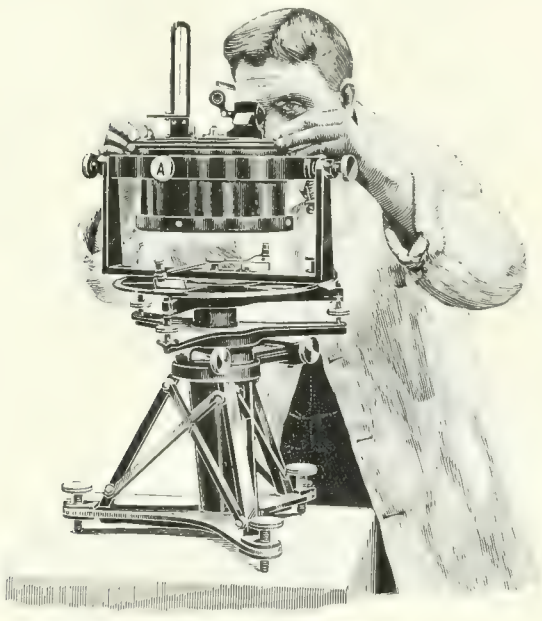
THE STANDARDIZATION AND CERTIFICATION OF NAUTICAL INSTRUMENTS.

IN view of the fact that Great Britian owns more than half the tonnage of shipping in the world, and has been the pioneer with regard to the formation of rules and regulations relative to maritime matters, it is somewhat remarkable that no official step has been taken with reference to the standardization and certification of nautical instruments. It may be said that a ship is typical of a large animal with a small brain, for all its apparatus for regarding impressions and directing operations can be easily concentrated into a small space such as the captain's or chief engineer's cabin. From this point of view the navigating bridge and the chart room contain all the nerve centres, and when they are properly equipped it may be reasonably said that the ship can be trusted.

A really comprehensive outfit of ship's instruments would include all branches of scientific effort and research. As a nation, we spend large sums of money every year, and our best naval officers are engaged in the survey of all the coasts and seas in the world, to reproduce the results in ships' charts and utilize their accuracy with perfect faith in laying off courses and positions by every kind of chart instrument, dividers, rules, protractors and station pointers. Our cleverest mathematicians and astronomers are continually engaged in observing and estimating the positions of stars, sun and moon for years ahead, in order that the sailor may be able to use his sextants and chronometers with all their extreme accuracy and sensitiveness. The inventions and improvements of the best opticians and instrument makers are devoted to the making of the finest and most powerful compasses, telescopes and binoculars, the tables mechanicians and electricians have worked out numerous self-recording apparatus for weather, temperature, time, speed, direction and messages of all sorts. Surely it may be said that a point of perfection has been reached: even the most scantily furnished ship is secure behind the ability of the scientists, officers and opticians who have worked out the present-day system of navigation. We venture to say that this would be so if a simple certificate of efficiency for every instrument was required before setting out to sea. The Board of Trade has many surveys and examinations, but it has never ventured to make any inquisition into the state of the instruments of the ship, and it is high time this was done. In Holland, Sweden, Norway and other countries, certificates of compass adjustment, the correct rating of chronometers, verifications of sextants and the general proper condition of the instruments are always produced, and we contend that no firm who cannot give a certificate of the accuracy of its instruments equal to that of the Observatory, is qualified to undertake the care of nautical instruments.

In order to ascertain how far the testing and verification of instruments is carried out by manufacturers, we recently paid a visit to the works of Messrs. Henry Hughes & Sons, Ltd., and what we there saw has confirmed our view of the question. Here, within 30 minutes of the Royal Albert and Victoria Docks, we saw compasses of various types being subjected

to tests for accuracy, period and deflection, some of them to the extent of minutes of error. This work is carried on in a testing house specially erected for the purpose, with a valuable circle and correct north mark set up at a distance. In the same house we saw the pillar and apparatus for testing sextants and giving a maximum of errors if not the complete certificate. In another shop we were introduced to the instrument for testing the parallelism of all prisms, glass mirrors and sun shades: binoculars and telescopes are also put to the test for definition, centring power and width of vision. Walking through the newly-erected forge at the rear, fitted with electric blowers, we came next to the compass shop where a dozen or more of highly qualified compass and binnacle makers are kept constantly on dry and liquid compasses for the bridge, wheelhouse and other parts of the ship. Here we saw the new pattern of spirit compass Messrs. Hughes are now making, with the special arrangement of bowl, needles and float, so as



Testing a Compass

to give instantaneous dead-beat action with a full sized card. This, in conjunction with the special new spiral springs, has proved most successful.

The adjoining illustration shows one of the Admiralty compasses, of which Messrs. Hughes are the approved repairers, being tested for accuracy.

Lamps, semaphores, telegraphs and sounding machines are turned out in this portion of the works, and on the upper floors we found the more delicate instruments being made in large quantities, sextants, quadrants, artificial horizons, station pointers, rulers, dividers, clocks and barometers in a special shop, card painting in another, and finally we reached the wood-working shop, where all the cases are made and the packing of the instruments is done.

Messrs. Hughes evidently thoroughly believe in the principal of certificates for all instruments every voyage, and think the work would be very much improved by the establishment of a proper standard of efficiency. They have lately erected a new standard clock and installed the time signal at their Royal Albert Dock shop, in order to be really on the spot and save the chronometers the joltings of a railway journey and the extreme change of temperature. They are also very keen on giving temperature rates to all chronometers when a long enough stay is made, and have made special arrangement whereby it can be done in ten days at a small charge. They are, we believe the only firm in London who correct their own charts, and will give a certificate every voyage that such charts as the ship carries and uses are thoroughly up-to-date.

We can only say that shipowners and their superintendents will quickly find that such standardization and efficiency work to their advantage, and we leave them to give practical expression to their appreciation of such efforts with such firms as take the trouble of systematic stardardization and verification of instruments.

MARINE BOILER EXPLOSIONS.

From the Board of Trade Reports.

REPORT No. 1929 deals with the explosion from the auxiliary condenser on board the s.s. *Avondale Castle*. The explosion occurred on board the *Avondale Castle* on the 14th February last, when the vessel was being taken from the East India Dock into the dry-dock at Blackwall, London, E. James Buchanan, a fitter, was slightly scalded, and Frederick David Adams, donkeyman, was somewhat severely scalded on the face and arms; both men have now recovered from their injuries. The condenser and covers were made of cast iron. The former was of the ordinary cylindrical type; it was 5 feet 11¾ inches long, 27 inches diameter, and ⅜ of an inch thick. The end covers were 35½ inches diameter, and were secured by twenty studs ⅞-inch diameter; the covers were ⅝-inch thick in the centre and ⅞ inch thick at the flange forming the joint, and were strengthened with two outside webs, each web being ⅝ inch thick and 1⅝ inches deep at the centre. The condenser was fitted with 389 brass tubes ¾ inch diameter, the circulating inlet and outlet valves were each 5½ inches diameter, and on the exhaust side there was a 2¾-inch drain valve fitted with a pipe leading to the feed tank. There was also a supplementary feed cock and pipe about ½ inch bore, so that extra feed could be supplied to the auxiliary boiler when required. On the cover at the forward end of the condenser, a relief valve 3⅜ inches in diameter was fitted and loaded to a pressure of 30 lbs. per square inch. The whole of the front cover, inside of the securing bolts, on the circulating side of the condenser, was completely blown out. The explosion was due to the exhaust steam pressure from the steering engine having been admitted to the condenser, owing to an oversight, when it was not in use, and passing through the supplementary feed-cock to the water side, the pressure was greater than the condenser door was able to withstand. The observations of the Engineer Surveyor-in-Chief are as follows:—In this case the exhaust steam from the steering engine of the vessel was, by mistake, diverted into a small auxiliary condenser which was not intended to be used at the time; and, a supplementary bye-pass cock being open, steam was also admitted to the circulating side of the apparatus, the doors of which were subjected to a pressure which one of them was unable to withstand. A considerable portion of the interior of the door was blown away, causing injury to two men working near. The cock which directed the steam to the condenser was opened by mistake, and to this cause the explosion is due.

Report No. 1931 deals with the explosion from a main steam pipe on board the s.s. *City of Edinburgh*. The explosion occurred on the 20th February last, when the vessel was in the English Channel. No person was injured by the explosion. The pipe which failed was a straight length, about 10 feet long and 9 inches in diameter, made of copper about ½ inch in thickness the edges being lapped and

brazed, with a brass flange brazed on at each end. The working pressure was 200 lbs. per square inch. The pipe fractured circumferentially for a short distance on the after side of the forward flange, a slight escape of steam taking place. This fracture gradually extended, until when it was examined, after the vessel's arrival in port, it was found to be about 7 inches long. The fracture was probably caused by the vibration of the machinery during very heavy weather, described as a hurricane, experienced on a voyage from Dunkirk to Glasgow, when the vessel was light. The observations of the Engineer Surveyor-in-Chief are as follows :— This report deals with the failure of a length of main steam pipe while the vessel was at sea. Severe stresses appear to have been set up in the pipe owing to the racing of the engines and the expansion of the range under working conditions ; and the pipe, being too rigid to withstand these, became strained near the flange and cracked. The owners have very wisely arranged to fit means for freer expansion, and it is hoped that no further trouble will be experienced.

Report No. 1974 deals with the explosion from the main boiler of the s.s. *Ethelbert*. The explosion occurred on the 12th July last, when the vessel was about 16 miles N.E. of the Longstone Light. No person was injured by the explosion. The boiler was made of steel, and was of the ordinary single-ended marine type, with two plain furnaces. It was 9 feet 3 inches long, and 9 feet 3 inches in internal diameter. The furnaces were 2 feet 10 inches outside diameter and $\frac{9}{16}$ inch thick, and the seams were welded. The shell plates were $\frac{11}{16}$ inch and the end plates $\frac{13}{32}$ inch in thickness. The combustion chamber backs and wrapper plates were $\frac{17}{32}$ inch thick, and the bottoms $\frac{5}{8}$-inch in thickness. All the usual mountings necessary for a marine boiler were fitted, including two spring loaded safety valves, adjusted for a working pressure of 130 lbs. per square inch. A hole about $\frac{3}{8}$ inch in diameter was formed at the side of one of the rivets in the bottom of the port furnace, at the back end, through which the contents of the boiler escaped into the stokehold, the pressure at the time being about 100 lbs. per square inch. The explosion was due to corrosion, set up internally by pitting, and externally by leakage from one of the rivets which secured the angle iron stiffener to the bottom of the furnace. The plate adjacent to this rivet thus became too thin to withstand the ordinary working pressure. The observations of the Engineer Surveyor-in-Chief are as follows :—This report deals with an explosion from the furnace of a boiler in a fishing boat. The plate became wasted locally, by corrosion, both internally and externally, to such an extent that the pressure within the boiler forced a hole through the thinned part. The vessel had to be towed into port as it was found impossible to maintain the water level in the boiler. The external corrosion was due to a leaky rivet which, it is thought, should have attracted attention to the defect before the point of failure was reached. Fortunately no one was injured.

Report No. 1954 deals with the explosion from a main steam pipe on board the s.s. *Boulama*. The explosion occurred on the 9th February last, when the vessel was about 60 miles S.W. of Ushant, on a passage from Las Palmas to Hamburg. No person was injured by the explosion. The pipe was made from a copper tube with a brazed longitudinal joint, and was bent at right angles to a mean radius of about 15 inches, about 2 feet 10 inches from the end which joined the boiler stop-valve chest. It was fitted with brass flanges, 10 inches in diameter and $\frac{7}{8}$ inch in thickness. One flange was connected to the boiler stop-valve chest by six bolts, $\frac{3}{4}$-inch in diameter, and the other to the length of pipe which joined the engine stop-valve chest, by seven bolts, $\frac{3}{4}$ inch in diameter. The distance from the centre of flange at the boiler end to the opposite end of the pipe was about 5 feet. It was $4\frac{1}{2}$ inches in internal diameter and No. 5 S.W.G. (·212 inch) in thickness. The pipe fractured circumferentially for a length of about 6 inches at the neck of the flange, joined to the starboard boiler stop-valve chest. The fracture subsequently extended to a length of about 9 inches, steam continuing to escape from it until the boiler stop valves were closed. The explosion was due to excessive stresses set up during heavy weather by the pitching of the vessel, the racing of the engines, and the consequent vibration. The vessel was in ballast at the time. The observations of the Engineer Surveyor-in-Chief are as follows :—This report deals with the failure of a steam pipe due to excessive vibration and racing of the engines while the vessel was encountering very heavy weather. The pipe range would appear to be somewhat rigid and wanting in elasticity under severe stresses. It is, however, satisfactory to know that the superintending engineer intends to fit more adequate means to allow for expansion and vibration.

UNIVERSAL SPANNERS.

A HANDY style of spanner, to which our attention has been called, is that placed on the market by The United Machine Tool Works, of 133, Upper Thames Street, London, E.C. It is termed the Universal Spanner, and partakes to some extent of the handiness of the shifting spanner and of the double-ended spanner, of which, indeed, it is a multiple type. Type A is adapted to take ten different sizes of hexagon nuts, say from $\frac{1}{16}$ in. to $1\frac{3}{8}$ in. Type B is adapted to take eight different sizes, but is specially made to admit of dealing with nuts in recesses where, for certain reasons, the tops of the bolts or studs require to be kept flush with or only projecting slightly above a bed-plate or bracket, and where a box spanner would otherwise be necessary to slacken, backen back or tighten up. These spanners are made of good, tough steel, black varnished and well finished. The standard length is twelve inches, and the weight of each is about two lbs. The price is moderate, Type A being 3/8 and Type B 3/6 for single spanners. The handiness of the spanner will be readily realized from the illustration. They are also made in smaller sizes, 5" to 6" long, specially suitable to motorists, at the price of 1/- each. The smaller size is arranged to be used as a spike spanner and screw-driver as well.

The Universal Spanner. Type A.

WE understand that Mr. William I. Taylor, who has represented the firm of Messrs. Clarke, Chapman & Co., Ltd., of Gateshead-on-Tyne, for the last twenty-eight years, and who for the latter part of that time was a member of the Board, has now severed his connection with that firm. He still continues as London Manager for the Darlington Forge Co., Ltd., who have taken a suite of offices at No. 70, Fenchurch Street, E.C., and will be assisted in the direction of that business by his sons, under the title of William I. Taylor & Sons.

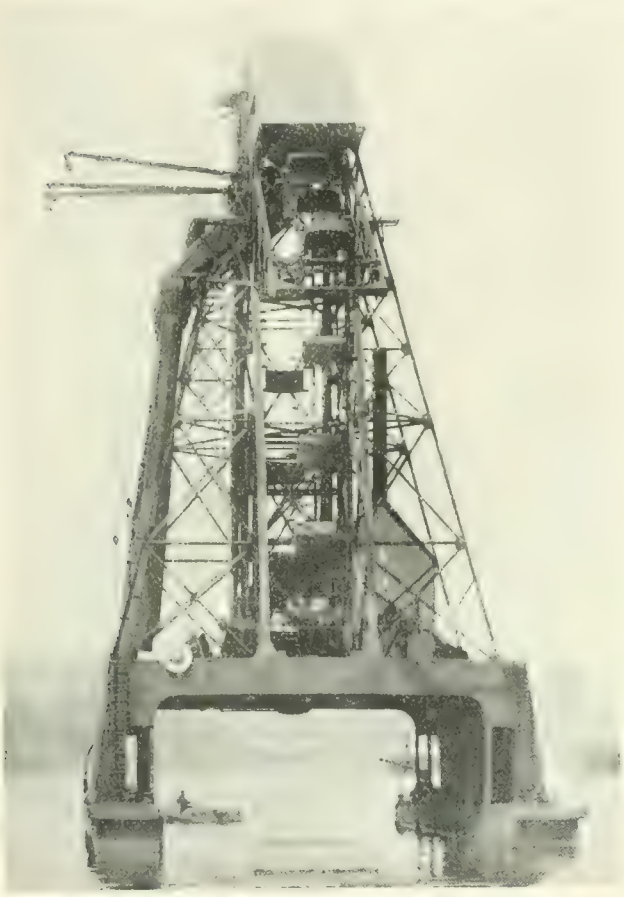
COALING OF STEAMERS' BUNKERS.

THE whole subject of coaling has ever been a vexing one from start to finish, beginning with the scattering of coal dust over the decks, continuing with the trimming to fill the space available, and ending with a wordy warfare over the quantity. Some ports have a name for quality, quantity and expedition, others have not so good a reputation. With regard to expedition, this is an element which has an important bearing on the choice of a coaling port, appealing to the shipowner and the shipper or supplier alike, where their interests are in harmony in respect to the time required to put into the bunkers one hundred tons. The spirit of emulation and the desire to earn as much as possible in the least time, have brought several ports into prominence for fast coaling. The appliances in use at different ports are many and varied. In Japanese and Chinese ports we have seen streams of men, women and in some cases children, with small baskets pouring along gangways, each one receiving a coin on the passing of the empty basket, or a tally mark to record the amount due for work done during the day. At Aden, Colombo and other Eastern ports, bags appear to be the usual measures used, so many to the ton, carried by manual labour from the barges to the bunker shoots. Where labour is high in price and its reduction becomes a matter of consideration, mechanical appliances have been introduced, one form being that of a steam barge fitted with winches to raise baskets of coal from the coal-boat to the port or hatchway, another being the coaling grab, discharging half a ton at each lift, with its interesting mechanism, for use on steamers with deck hatchways; or where the nature of the ground and the disposition of the steamer admits of it, waggon lines and tips with sectional shoots led to the hatches or coaling ports.

The illustrations show an appliance recently introduced for coaling by means of buckets fitted dredger-fashion on a ladder which dips into the coal barge. The

Suisted's Patent Coal Elevator discharging.
Designed and built by Messrs. Day, Summers & Co., Ltd., Southampton.

apparatus was designed and built by Messrs. Day, Summers and Co., Southampton, a firm whose historic name is well known. Since leaving the hands of the builders it has been tested at work, and found capable of lifting two hundred tons per hour, the specified quantity being one hundred tons. After being towed to London it was set to work in the Royal Albert Dock to compete with the other mechanical appliances which many years ago superseded the elemental hand labour. This is not the first apparatus of the kind tried in London and elsewhere for coaling, as we remember a similar arrangement some fifteen years ago, which did not make much headway. The new appliance, however, is an improvement, and possesses new features, so that it promises to fill an



End View.

Coaling the *Alnwick Castle*.

important place in the field of coaling operations when experience has been gained in the use of it. One advantage it has is that there is no scattering of coal dust during the working; it also has the merit of simplicity and is not costly. The seating on which the framework is secured is composed of two pontoons bound together, the intervening space being sufficient for a large coal barge to enter, and in the centre line the bucket ladder is hung. The engine for revolving the tumbler is at one end of the twin pontoon, on an elevated platform, the motion being carried to the tumbler shaft overhead by a vertical shaft. Preferably the barge has sloping sides with a view to self-trimming, so that the coal will tend to run to the centre line, narrowing the side-travel distance of the barge as the coal is lessened in quantity, and thus give the buckets a better opportunity of filling. The coal is emptied by the buckets into a hopper at the top of the framework, from which tube-shaped shoots are hung so that they can be directed to the coaling ports or hatches. There are three of these tubes, so fitted that they can be led to different positions, and, being telescoped in adjustable portions, can be lengthened or shortened to suit each case. While the illustrations show but three shoots, these can be increased in future structures as the system of coaling by this means is developed. The height of the hopper and the length of the ladder can also be extended to suit any height of discharge, while weighing arrangements can readily be fitted. The apparatus is the property of The Suisted Patent Coal Elevator Co., Ltd., of 6, Lloyd's Avenue, London.

MESSRS. SCHMIDT'S SUPERHEATING CO., LTD.—Owing to the large increase in the business of Messrs. Schmidt's Superheating Co., Ltd., arrangements have been made to combine the Patents owned by Messrs. Schmidt's Superheating Co., Ltd., with the English Patents of Messrs. The American Locomotive Co., and those of Mr. Vaughan Horsey, of the Canadian Pacific Railway, and this Company has been formed to carry this into effect. In the United States, a Company, under the title of Messrs. The Locomotive Superheater Co., has been formed to acquire the Patents of Messrs. Schmidt, Cole, Vaughan Horsey and other American Patents. The Schmidt'sche Heissdampf Gesellschaft of Cassel has been formed to deal with all the foreign Patents of the above-mentioned Companies from the office of that Company at Cassel, Germany. This Company has been formed to deal with the British, Colonial and South American Patents of the above group. The locomotive and marine business of Messrs. The Schmidt's Superheating Company (1910), Ltd., will be carried on at 28, Victoria Street, Westminster, as heretofore. The three Companies above mentioned will continue to receive the guidance and direction of Dr. Schmidt.

THE SOCIETY FOR NAUTICAL RESEARCH.—This Society has been formed to encourage research into nautical antiquities and matters relating to seafaring and shipbuilding in all ages and among all nations. For this purpose a monthly journal, to be called "The Mariners' Mirror," is published, to contain original articles, pictures, etc., and generally to serve as a medium of inter-communication between members of the Society. Another object of the Society is to collect material with a view to the ultimate publication of a complete Nautical Encyclopædia. One guinea is payable on admission to membership, with an annual subscription of half-a-guinea. Prince Louis of Battenberg is the President of the Society. The first number of "The Mariners' Mirror" has been issued and contains articles on "Eminent marine artists," "The Boatswain's Call," "The Last of the East Indiamen," "Of Decks and their definitions," "Captain Nathaniel Boteler," "Notes and Queries." All further particulars of the Society may be obtained of the Hon. Sec., Mr. Douglas Owen, 9, Wilbraham Place, London, S.W.

THE IMPERIAL JAPANESE BATTLESHIPS "AKI" & "SATSUMA."

CONSIDERABLE interest is attached to the newly-completed *Aki* and *Satsuma*, as being the first Japanese-built battleships. Prior to 1905 the fleet was, with a few exceptions, entirely of foreign construction, the major number of the ships having been built in this country. During the war, however, it was decided that the Imperial dockyards should be entrusted with the construction of the battleships and cruisers of the programmes for that and for future years, the *Satsuma* being laid down at Yokosuka and the *Aki* at Kure. At the same time the cruisers *Tsukuba* and *Ikoma* had just been commenced at Kure, the Government having taken the bold step of placing orders for four ships of from 15,000 to 19,500 tons displacement, with yards in which nothing larger than second-class cruisers had hitherto been built. The ability of the Japanese to execute these orders was not doubted, but it was generally recognised that the rate of construction would not be so fast as in foreign yards, owing to the initial difficulties both in building and design which would have to be overcome. Although some five years have elapsed since the keel plates were laid down, and the *Aki* is only now just completing—or has just completed—her trials. The delay is not wholly attributable to lack of facilities for fast construction, as it must be remembered that eight battleships and five large cruisers captured from the Russians were under repair and reconstruction simultaneously, and energy was chiefly devoted to getting these prizes into commission as soon as possible. In addition, there seem to have been some alterations in the plans of the ships as regards armament, 6-inch guns having been substituted for 4·7-inch in the case of the *Satsuma*, while a proposition to replace the 10-inch weapons by 6 12-inch seems to have been under consideration and then rejected as impracticable.

The extent to which war lessons were responsible for the main features of the design is an open question. Our own Admiralty had decided that the question of range control would be greatly simplified by the adoption of a uniform calibre for the big guns; that the secondary battery of 6-inch guns had little battle value, and that the 3-inch gun was amply big enough to ward off torpedo attack—hence the appearance of the "Dreadnought." The advisability of abolishing the 6-inch gun was at the time hotly debated, and both its retention and also that of the 9·2-inch is still strongly advocated.

The publication of details of the *Satsuma* and *Aki* greatly strengthened the arguments of those who adversely criticised the "Dreadnought" design. Here were the Japanese, who should surely be best able to judge the necessities of future warfare from actual experience, producing ships carrying mixed big-gun calibres and retaining the 6-inch battery! On the face of it, the *Satsuma* seems a strong argument against the "Dreadnought," until other factors influencing the Japanese design are taken into consideration. In the first place, the English-built *Katori* and *Kashima*, carrying 4 12-inch, 4 10-inch and 12 6-inch guns, provided a good basis from which an improved and enlarged type could be evolved. The "all-big-gun" ship had already been mooted, but the difficulties in the way of designing and building such a ship were evidently more than the Japanese Admiralty considered they could then overcome. Thus the *Satsuma*, although often classed as a "Dreadnought," is really only an enlarged and improved "Lord Nelson," and the apotheosis of the "mixed-calibre" school of design, carrying, as she does, the heaviest armament put into any ship of the pre-"Dreadnought" era. The *Kawachi* and *Settsu*, which followed them on the stocks, carry a uniform armament of twelve 12-inch guns and retain the 6-inch secondary battery, showing (1) that the adoption of the "all-big-gun" principle by the Japanese was simply a question of time and experience, and (2) that the 6-inch gun is expected to play some part in battleship actions, either for anti-torpedo-boat work or for use against the opposing "line" ships—possibly for both.

The *Aki* is the larger of the two ships, displacing 19,750 tons against the *Satsuma's* 19,250 tons, their dimensions being:—

	Length over all.	Beam.	Draught (max.).
Aki	499	84	$28\frac{3}{4}$ feet
Satsuma	482	$83\frac{1}{2}$	$28\frac{3}{4}$,,

The armament of each consists of four 12-inch guns paired in 8—12-inch turrets fore and aft in the centre line; twelve 10-inch in six 8-inch turrets amidships; twelve 6-inch, of which eight are mounted on the main deck amidships in a 6-inch box battery, and four in the bows and stern. A saluting battery of four twelve-pounders is carried on the superstructure between the 10-inch guns. From this it is evident that the Japanese ships are far more powerful than the "Lord Nelsons" and French "Danton" class, with which they compare as follows:—

	AKI	*LORD NELSON.*	*DANTON.*
Displacement ..	19,750 tons	16,500 tons	18,700 tons
Dimensions	$499 \times 84 \times 28\frac{3}{4}$	$445 \times 79\frac{1}{2} \times 28$	$480 \times 84\frac{3}{4} \times 27\frac{1}{2}$
Armament.....	4 12-in. guns	4 12-in. guns	4 12-in. guns
	12 10-in. ,,	10 9·2-in. ,,	12 9·4-in. ,,
	12 6-in. ,,	15 12-pdrs.	16 12-pdrs.
	4 12-pdrs.	16 3-pdrs.	10 3-pdrs.
Submerged Torpedo Tubes ..	5	5	2
Armour—			
Belt	9—6-in. (bow) 4-in. (stern)	12—6-in. (bow) 4-in. (stern)	10—6 in. (ends)
Upper Belt ..	8—6 in.	8-in.	$2\frac{1}{2}$-in. (bows only)
Big Guns	12—8-in.	14—8-in.	$12\frac{1}{2}$—11-in.
Secondary do.	8-in.	7-in.	$8\frac{3}{4}$-in.
Tertiary do...	6-in.	nil	nil
Protective deck	2-in.	2-in.	3-in.
I.H.P. (designed)	25,000	16,750	22,500
Speed.....	20·5 knots	18·5 knots	19·4 knots
Coal	1,000-2500 tons	900-2,000 tons and oil	925-2,010 tons
Machinery	Curtis turbines	Reciprocating	Parsons turbines

The hull area protected by armour is very extensive, more so than in the British and considerably more than in the French ships, as these latter have their upper and main decks quite unarmoured. Height of guns above water works out in favour of the *Danton*, as, with the exception of the after-pair of 12-inch guns, her turrets are all placed a deck higher than those in the other two types. Other comparative points are given in the table, from which it may be seen that the *Satsuma* possesses an all-round superiority over the British and French ships under notice.

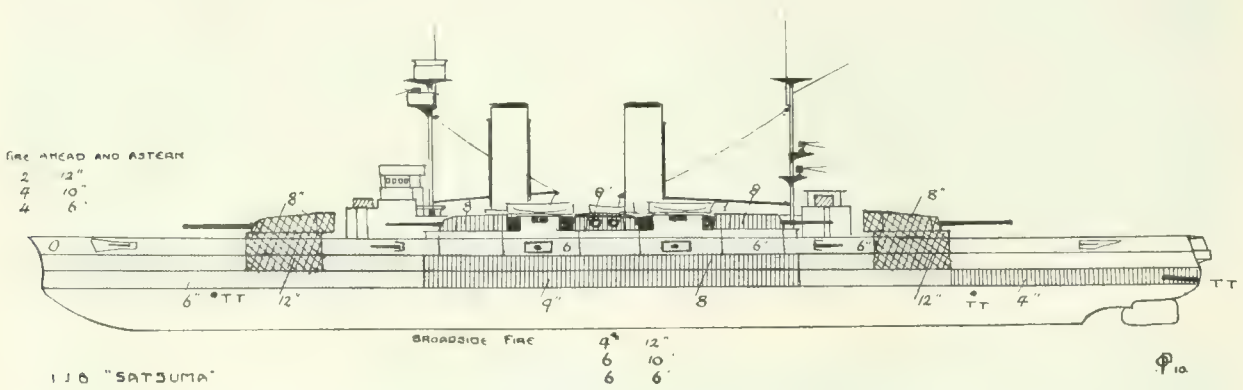
Japanese Battleship, *Satsuma*.

Japanese Battleship, *Aki*.

The minor differences between the *Aki* and her sister are due to the former being fitted with Curtis turbines, while the latter has lower-powered ordinary reciprocating engines, and consequently a funnel less. Other features, such as the peculiar superstructure forward on the *Aki*, the difference in the position of the main masts and absence, in the *Aki*, of the recesses in the main-deck side, under the 10-inch gun turrets, so noticeable in the *Satsuma*, may be mentioned in passing. Apart from the characteristic "swan" bow and general spacing of the masts and funnels, they are very much like our "King Edwards" in profile.

On trial the *Satsuma* is reported to have done 20·5 knots, although designed for 20 knots only. The *Aki* should therefore top 21 knots easily, being provided with a nominal 25,000 H.P. against the 18,500 H.P. of her sister. Both have the standard Japanese Miyabara boilers.

Turrets are worked both electrically and by hydraulic machinery, the guns being of the Elswick 1904 models, and similar to those in the *Katori* and *Kashima*.



Plan of the battleship *Satsuma*.

The torpedo-nets are stowed along a main-deck shelf which extends for more than three-quarters of the ship's length; there are eighteen booms for hoisting them out on either side—some four or five more than our longer "Dreadnoughts" carry.

THE INSTITUTE OF METALS.—The annual meeting of this Institute was held on January 18th, when the Report for the year was presented, and other business transacted. The Corrosion Committee's report dealt with the present state of our knowledge of the corrosion of non-ferrous metals and alloys, with suggestions for a research into the causes of the corrosion of brass condenser tubes by sea water. Many papers have been written on this subject, and the different views presented have been tabulated for the guidance of the committee in considering the subject as set forth under the title given by Mr. G. D. Bengough, M.A. The electrolytic action resulting in the decay of one metal in presence of another in sea water was set forth as a prolific cause of wastage and failure. The critical points in the mixing of alloys and in the conditions of work, with regard to solutions, temperature and pressure, were indicated as aspects of the subject demanding close study. Other papers were read, dealing with "Corrosion of Condenser Tubes on Shipboard," by Engineer Rear-Admiral J. T. Corner, wherein was advocated the attachment of pieces of soft iron to chests where galvanic action occurred between cast iron and brass in presence of sea water; "A New Critical Point in Copper-zinc Alloys," by Professor H. Carpenter, and an appendix to this by Mr. C. A. Edwards, M.Sc., on "The Nature of Solid Solutions." Other subjects treated were anti-friction bearing metals and electro deposited silver.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our Own Correspondent.)

Portsmouth Dockyard.

ON January 11th, the battleship *Neptune* was commissioned by Captain De Bartolome for particular service. She will first proceed to the Mediterranean on an experimental cruise, and carry out gunnery tests in Aranci Bay. Afterwards she will join the Home Fleet, and when the change of Commander-in-Chief takes place she will relieve the *Dreadnought* as flagship, that vessel having been ordered to pay off for a refit. This is in accordance with what was stated in these columns several months ago. As the *Neptune* was laid down on January 19th, 1909, she has thus been completed for sea in a week under two years. The *King George V.*, as our new battleship is to be named, was officially commenced on January 16th. It was confidently anticipated that the King and Queen would have paid us a visit for t e occasion, but it is hoped that when the vessel is launched about September their Majesties will be present. The ceremony was quite a private one, only the officials of the yard and their wives being present. Lady Curzon Howe the wife of the Commander-in-Chief, having declared the keel plate well and truly laid, Rear-Admiral Tate, the admiral superintendent, thanked her ladyship, and then Mr. Apsey, on behalf of the constructive staff, presented her with a souvenir in the form of an inkstand, shaped like a keel plate. Outside official circles nothing is known in what respects the new vessel is to differ from her predecessors, but a few details appear to have leaked out, and it seems certain that the ship will be about a thousand tons heavier than the *Orion* and twenty feet longer than that vessel. This will give her a length of about 565 feet and a beam of just on 90 feet. The armament will, it is stated, be similar to that of the *Orion*, while her engines are to be of 31,000 horse power, and her speed 21 knots. A large quantity of material had been prepared, but as only £95,000 is allowed for construction in the current Estimates not very much progress will be made before April. The statement made in a London journal to the effect that the authorities at Devonport had been directed to prepare No. 8 Dock at that port for the battleship *Orion* caused some astonishment. The *Orion* was to be towed round to the western ort for completion because there was no dock at Portsmouth capable of receiving her. It is certain that whoever set the report afloat did not know very much about things, seeing that the *Orion* was only recently taken out of No. 15 Dock, where she was placed soon after her launch. The entrance width of No. 15 Dock is 94 feet, and that of the Devonport dock is a foot more, while the extreme width of the *Orion* is 88 feet, so there is very little room to spare. It is strange how such reports are circulated. The refit of the cruiser *Good Hope* is to be completed by the middle of February, and day and night shifts are being worked in the engine and boiler rooms so as to have the vessel ready for commissioning by the end of the financial year. She is to relieve her sister the *Drake*, as flagship of

the Fifth Cruiser Squadron, when Rear-Admiral Burney succeeds Rear-Admiral Hamilton in command. The *Drake*, flagship of the Fifth Cruiser Squadron, is then to be taken in hand for a refit. The cruiser *Venus*, which was damaged at Dover during a gale recently, also necessitated day and night shifts to get her ready for the cruise of the Atlantic Fleet. The battleship *King Edward VII.*, flagship of the vice-admiral of the Second Division of the Home Fleet, is having defects in her steering gear made good, and the *Hindustan* is temporarily acting as flagship. The cruiser *Royal Arthur* has relieved the *Crescent* as parent ship of the cruisers in the Fourth Division of the Home Fleet, and is to be taken in hand to have magazine cooling apparatus fitted.

Devonport Dockyard.

The keel plate of our new battleship, which is to be named the *Centurion*, was laid on January 16th, the ceremony being performed by Lady Fawkes, the wife of Admiral Sir Wilmot Fawkes, the Commander-in-Chief, in the presence of the principal officers of the establishment. Lady Fawkes also by means of a pneumatic riveter drove home the first rivet of the ship, Mrs. Stokes, the wife of the admiral superintendent, fastening the second, while other ladies similarly drove rivets, each of which was marked with their initials by the workmen. The *Centurion* will be the eighth vessel of the name to appear in the "Navy List," but she is the first to be built at this yard. Preparations were so well advanced that her construction will go on very smoothly. For the current financial year the sum of £96,723 is to be spent on her. It is understood that the vessel will mark a further development of the "Dreadnought" class in displacement, dimensions, gun power and armour protection. The main armament will be the same as that of the "Orion" class now building—ten 13·5 inch weapons. By the end of January the cruiser *Lion* will have been fourteen months under construction, and by that time it is expected that she will be undocked and placed in the Prince of Wales' Basin. During the five and a half months since she was launched excellent progress has been made. The water-tube boilers have been placed in position and generally connected up and covered in; the engine rooms have been prepared for the turbines; a number of the heavy upper deck fittings have been fixed; and the unarmoured space above the upper deck has received the greater part of the fittings. In addition, the broadside armour has practically all been fixed, and generally splendid progress has been made all round. The cruiser *Indefatigable*, although her eight hours' trial run was made in very bad weather, attained a mean speed of 26 knots—one knot in excess of her designed speed. She is now in dock undergoing the finishing touches in readiness to be commissioned on February 23rd for service in the Home Fleet, that will be two years to the day from the date she was laid down. The old *Emerald*, which was recently renamed the *Impregnable III.*, has had her alterations completed, and she has now been linked up with the *Impregnable* and *Inconstant* as a part of the boys' training establishment. The destoyer *Itchen*, which has been relieved in the Second Destroyer Flotilla by the new destroyer *Comet*, has been taken in hand for a refit, on the completion of which she will be commissioned for service in the Third Flotilla at the Nore. Commodore Wemyss, whose flag had been flying in the steamship *Balmoral Castle* since September 10th, rehoisted it on January 2nd on resuming his duties as commodore of the Naval Depot. Commodore Tufnell, who had been temporarily discharging the duties, was, by a curious coincidence, promoted to rear-admiral the next day consequent on the retirement of a flag officer. Instructions have been received that the battleship *Nile*, of the Fourth Division of the Home Fleet, is to be dismantled during the coming year and withdrawn from active service. It was understood that the vessel was to be refitted and prepared for service at the Dundee submarine base. The *Nile*, which was built at Pembroke, was launched in 1888.

Chatham Dockyard.

Much satisfaction has been expressed locally that our new cruiser is to be named the *Chatham*. The Mayoress laid the first keel plate on January 3rd, and by means of the pneumatic riveter drove the first rivet, other rivets being driven by Lady Drury, Mrs. Ommanney, and the Mayor. The vessel is to be an unarmoured second-class cruiser, and she is being constructed on No. 8 slip. She will be a sister ship to the *Active*, now being built at Pembroke, but several improvements have been introduced into the design since that vessel was laid down in July last. About £54,000 will be spent in advancing the vessel during the current financial year, £11,000 of which will be for labour. The *Chatham* will be built under the supervision of Mr. E. Bate, the first constructor, who was complimented by the Admiralty for the expeditious manner with which he carried out the repairs to the cruiser *Sappho*, which was damaged in collision during the manœuvres eighteen months ago. Another of our submarines, *D7*, was launched on January 14th. The ceremony was performed by Mrs. Ricardo, wife of the deputy-superintendent. Captain Ricardo, and only dockyard officials and their wives were admitted to see the vessel take the water. Afterwards the submarine was docked to be completed and equipped for sea. A record performance has taken place here with regard to the battleship *Formidable*, which came into the steam basin at 10-20 p.m. on January 12th, and passed out at 10.40 a.m. on the 14th. In just over thirty-six hours her four 12-inch guns were exchanged and her gun sights tested. The expeditious manner in which the work was carried out elicited the commendation of the Commander-in-Chief at the Nore, Admiral Sir Charles Drury. The battleship *Magnificent* has completed her refit and resumed her duties in the Nore Division of the Home Fleet. The battleship *Lord Nelson* has also completed her refit and gone on to Sheerness, where she was paid off from the First Division of the Home Fleet and recommissioned for the Second Division. She will relieve the *Africa*, which is to be refitted here for service as flagship of the Third and Fourth Divisions of the Home Fleet in place of the battleship *Bulwark*. Another battleship, the *Irresistible*, whose refit cost over £70,000, has been completed and has carried out her steam trials. The cruiser *Blenheim* has come in for a refit. Her duties with the First Destroyer Flotilla are being carried out by the cruiser *Antrim*, of the Nore Division of the Home Fleet. The scout *Pathfinder*, which was recently relieved in the First Destroyer Flotilla by the new cruiser *Blanche*, has completed her refit and has been recommissioned for the Portsmouth Flotilla. The cruiser *Barham* was to have arrived from the Mediterranean in time to recommission by January 24th, but it has been announced that she will not return to England until the end of March. The *Mosquito* and *Viking* have completed their refits and have proceeded to Harwich to rejoin the First Destroyer Flotilla. Another destroyer, the *Foyle*, which has been refitted at Pembroke, has arrived here and been commissioned for the Nore Flotilla.

Sheerness Dockyard.

A salvage party under Commander Munro went round to Harwich in the tug *Diligent* to carry out operations for the salvage of the special service vessel *Elfin*, which foundered after being in collision with Submarine *C8*. The operations have been attended with success, and the *Elfin* has been beached at Shotley for temporary repairs after which she will be brought on here. The cruiser *Highflyer*, which joined the Nore Division of the Home Fleet a few weeks ago, after refitting at Devonport, is to relieve the *Hyacinth* as flagship on the East Indies station. The *Highflyer*, which has previously served two commissions as flagship in the East Indies, is to leave on February 26th. The battleship *Magnificent*, of the Nore Division, was at first ordered to be employed for the training of stokers at Devonport, but it is now thought that a vessel fitted with water-tube boilers will be more suitable for the purpose. Torpedo boat No. 072, which was damaged in collision three months ago, has been passed out of dockyard hands upon completing repairs, which included the fitting of a new stem and the partial reconstruction of her bows. Torpedo boat No. 12 has finished her duties in connection with Dartmouth Naval College, and has joined the Nore Flotilla. This brings the 26-knot ex-coastal destroyers division of the flotilla up to twenty-four, the strength fixed at the time of the recent reorganization. The battleship *Triumph* was recommissioned at this port on January 12th for further service in the Mediterranean by Captain Weymouth, who had been for some time past a member of the Ordnance Board. Her late commanding officer, Captain Eyre, has taken up the duties of Chief Inspector of Naval Ordnance in succession to Rear-Admiral Farquhar. It has been decided to sell the battleship

Camperdown and the cruiser *Tribune* and *Pique*. This will dispose of the obsolete ships which have been lying in the River Stour, near Harwich, with the exception of the cruiser *Pactolus*. The *Camperdown*, it may be recalled, achieved notoriety through running down the *Victoria* some seventeen years ago in the Mediterranean. She has been employed on duties connected with Section III. of the Submarine Flotilla. Several thousand pounds had been spent on the *Pique* at this yard about six years ago, when the order came for her to be "scrapped." An improvement is shortly to be made in the Medway which will be a great convenience to private ships, as well as to His Majesty's vessels. The Admiralty have decided to place fifteen additional gas buoys in the river between this port and Chatham.

Pembroke Dockyard.

The cruiser *Blonde*, which since she was launched on July 22nd had been lying alongside the Carr Jetty for the purpose of receiving her boilers and machinery, has now been dry docked. A good deal of work is still to be done on the hull and fittings, but generally she is in a very forward state, and there is every reason to anticipate that she will be completed and ready for the pennant in less time than any previous vessel of her class. It is expected that her steam trials will take place during February, and if so she should be out of hand by the end of June. The cruiser *Active*, which was laid down about a week after the *Blonde*, was launched, is to be launched during the third week in February. The bottom plating has been so jar advanced that the contracting engineers have commenced boring operations for the propeller shafting. Strenuous efforts are being made to complete the *Active*, which is being built on No. 5 slip. It is proposed to lay down our new vessel. the *Amphion*, on the same slip immediately the *Active* is launched. It is to be regretted that the new vessel is not to be built on No. 1 slip, for it is certain that the £10,200 voted for the *Amphion* for labour before March 31st cannot be expended, if the vessel is not laid down until nearly the end of February. The outlook for the yard is very promising. It was stated recently by Dr. Macnamara that no discharges were intended during the year 1911-12, and assuming that the practice of sending destroyers here to be refitted is continued, which there is no reason to doubt will be the case, there will be plenty of work to provide employment for the majority of the men during the greater part of the year, seeing that the *Active* will not be finished before January of next year, and the *Amphion* before the following August. It is confidently anticipated that two vessels of the "Town" class will be allotted to us during the coming financial year, but we shall know more about that when the new Estimates appear. With regard to repair work, we still have the destroyers *Cheerful* and *Coquette* in hand.

INSTITUTE OF MARINE ENGINEERS.

Causes of Deterioration in Boilers.

AT the Institute of Marine Engineers on Monday, January 16th, a paper on "Causes of Deterioration in Boilers and Measures tending to prevent or remedy them," by Mr. C. C. Nelson (Member), was read, in the absence of the author, by the Hon. Secretary. The paper was originally read before the Institution of Engineers and Shipbuilders in Hong-Kong.

Mr. John McLaren (Member of Council) presided.

In the course of his paper the author said corrosion was caused chiefly through the oxidation of the steel by acidulated boiler water, and by electro-galvanic and thermo-galvanic action. Where the water was acidulated, the remedy was to use an alkali, preferably carbonate of soda or caustic lime. Chloride of magnesia was always present in sea water, and was exceedingly injurious. It attacked iron or steel, with or without the presence of air, at about 212°F. Ammonium, sodium, potassium, barium and calcium only attacked in the presence of air, the order given being the order of their corrosive power. Zinc salts acted as a preservative in boilers, and mercury salts were also known as an effective protector against rusting. He advocated the use of filters for feed water, to arrest solids and oils, the presence of the latter very often leading to overheating. Impurities in the metal had a great deal to do with corrosion. Pickling the plates had been tried with partial success. He submitted figures to prove that the occlusion of gases by metals did take place under certain conditions. Zinc was put into boilers to prevent corrosion, but zinc put into boilers to absorb galvanic action was a fallacy, and the polishing of contacts insisted upon was, in his opinion, a waste of time. Thermo-galvanic action was caused by unequal heating in the plates, but he did not think this action exerted much influence in the corrosion of boilers. The action of stray electric currents also was blamed for a good deal more than it deserved. He recommended that those in charge of boilers should see that steam was raised slowly, that the water should be kept circulating when raising steam, that the boiler water should be kept slightly alkaline, and that scumming and blowing down should be resorted to, but with great care and attention.

In opening the discussion Mr. W. McLaren said he agreed that the water should be filtered where there was any danger of oil being present. With regard to zinc plates, a sure contact was effected by the use of studs. He considered that a fair "breathing space" should be allowed for the boiler, as, if it were tightened up too much, grooving was likely to result. Mr. F. M. Timpson considered that instead of blowing down, the modern practice was to use an evaporator and run all the time with fresh water. Bad circulation of the water was obviated in many instances by the use of patent circulators. Mr. P. S. Doherty said that in land installations apparatus was used whereby oil was extracted from the exhaust steam to the extent of about ·003 grains per gallon. Mr. G. W. Newall was of opinion that the modern high pressures, with the resulting increase in temperatures, had a great deal to do with the corrosion experienced. He described an experiment showing the effect of oil in causing a local high temperature of the plate. Mr. W. Walker said corrosion on the line of the firebars was very seldom found in a Lancashire or Cornish boiler, and this seemed to disprove the author's contention that straining of the plates was the cause, as this was equally applicable to both cases. He cautioned engineers against supposing that the formation of scale prevented corrosion going on underneath. The practice of blowing down advocated by the author was actually detrimental to the boiler and resulted in the formation of scale. Mr. A. Robertson considered that the position of the feed water inlet was responsible for deterioration in the boilers, and Mr. A. Cooke advocated using a strong solution of soda for a period of about twenty-four hours for preventing the formation of scale. The Chairman said that usually the filter was placed on the suction side, where there was great possibility of the oil being forced through, instead of on the pressure side. The Hon. Secretary (Mr. Jas. Adamson) said the value of pickling the plates, referred to by the author, lay very largely in removing the mill scale, which, if left on the plate, accelerated the pitting action. He thought the practice of introducing zinc into boilers was beneficial, and when a proper contact was effected, zinc plates or electrogens had proved of value in preventing corrosion. The quality of the metal undoubtedly affected corrosion and other troubles, and in this respect the view had been advanced that a bad plate was produced when more than a certain proportion of phosphorus and nitrogen was found in the composition of the steel. He agreed with previous speakers that blowing down was detrimental to boilers.

MESSRS. DOULTON & CO., LTD.—We have pleasure in giving publicity to the fact that Messrs. Doulton & Co., Ltd., of the Royal Doulton Potteries, have been appointed Potters to His Majesty King George V.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.—On January 27th, the resumed discussion of Mr. D. B. Morison's paper on "The Economical Working of Reciprocating Marine Engines and their auxiliaries" took place. Mr. D. B. Morison replied to the discussion that had taken place on his paper. The Institution's Conversazione will be held on February 3rd.

MR. JOHN CLARK.

THE photograph we have pleasure in reproducing is that of Mr. John Clark, consulting and superintending engineer, who has been well known to many of our readers in this country and in India for the last thirty years. He was born and brought up in Campbeltown, Argyllshire, where he spent his school days till the choice of a trade was determined upon. Leaving home, he was sent to Glasgow, where he served an apprenticeship of five years with Jas. Aitken & Co., Cranstonhill, Glasgow, his first steamer were of the simple type, two cylinders with surface condensers, the boiler pressure being 25 lbs. Proceeding to India he served on the coastal trade for some years, gradually obtaining promotion through the various grades to chief engineer, passing the examinations for such promotions and entitling certificates in India. Appointed assistant superintending engineer at Calcutta in 1874, he was promoted to acting superintendent at Bombay four years later, and simultaneously with that he was appointed by the Government of India a member of the Board of Examiners for granting certificates to marine

MR. JOHN CLARK.

afterwards taken over by Rait & Lindsay. The shipbuilding firm in close connection with the engineering works was Aitken & Mansel, Whiteinch, Glasgow. During his apprenticeship, Mr. Clark served in the fitting shop and the drawing office. The management of the works was under the control of the late David Rowan and Dr. Kirk, whose subsequent changes of location and individualities are well known in the engineering world. Further experience was gained in the works of Denny & Co., Dumbarton, and when the season was ripe for another change, an opening in the service of the British India Steam Navigation Co. was taken advantage of, and Mr. Clark joined the *Ethiopia*, in 1868, as fourth engineer. The engines of engineers. Returning to Calcutta in 1881, he was appointed superintendent engineer at that port, the chief office of the Company in India. In 1887 he returned home, and became the resident engineer of the Company in Glasgow. The head office being subsequently removed from Glasgow to London in 1893, Mr. Clark was also transferred, and has been resident in London since that date, serving as the consulting superintending engineer for the Company, after his long term of sea and shore work in the East. His genial and kindly nature is known and appreciated by a large circle of friends and well-wishers. He is a member of the Institution of Engineers and Shipbuilders in Scotland, an Associate Member of the

Institution of Naval Architects, and a Member of Council of the Institute of Marine Engineers, in which he takes a deep interest. Besides the technical societies, he is also interested in the county associations of Scotland with which he is connected, and the religious-social societies in the district wherein he resides.

It is with regret that we have received intimation, as we are going to press, of the death of Mr. W. W. Wilson, Local Superintendent Inspecting Engineer of the P. and O. Company at Greenock, in the sixty-second year of his age. Mr. Wilson was well-known to engineers sailing out of the Port of London, while acting as assistant to Mr. Manuel, and the notice of his death will be received by a large number of our readers with deep regret.

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

Paris a Seaport.

MANCHESTER is not, it would appear from French accounts, to be the only inland town which is destined by force of her own energy to become a seaport. Paris is fired with a similar ambition. But in the case of the French capital it is not altogether the commercial aspect which makes the proposals attractive. Last winter it will be remembered large districts of the gay city were flooded out, and it is felt that something drastic will have to be done to render the recurrence of such unpleasantness impossible, and the suggestion of a large canal, which might help to dispose of the floods' waters seems to be one of the best ways out of the difficulty. Such a canal, if constructed, would have the additional advantage of facilitating commerce, and of allowing the steamers which now have to discharge at Rouen to bring their cargoes up to Paris herself. Since the reign of Henri IV. the idea of such a development has from time to time been put forward, the proposals being originally urged on by the difficulties in the way of bringing goods forward by such roads as then existed. After the Napoleonic era had covered France with a network of military roads, attention was again called to the desirability of building such a canal. It was not, however, till 1825 that a Company was actually formed for the purpose of providing a waterway, with a minimum depth of 13 ft., which should be capable of affording facilities to steamers up to 200 tons burden. It was to run parallel to the river and would entail the construction of some sixteen locks. Before, however, anything was done towards materializing this project, important political events occurred which entailed its postponement, and the advent of railways, with the facilities they afforded, diverted the public mind from canal schemes for the best part of half a century. Between the years 1878 and 1888, however, over three millions sterling were spent on the improvements of the Seine, which was divided into ten sections by the provision of some nine dams. This made the channel capable of carrying heavier vessels than the ordinary canal-boat of the French system, which is limited by the formation of the artificial waterways of the country to a load draught of some 6 feet 6 inches. At certain seasons of the year a depth of three times that figure may be found in the improved Seine. The present plan would cost some thirteen millions more and would therefore entail a toll of at least three-and-a-half francs a ton for its use for a single journey. This expenditure would only provide facilities for the class of vessel which at present can reach the port of Rouen, as it would not do anything for the channel below that city, and it would not therefore tend to increase the volume of traffic, especially as it is not thought that it would attract any trade for places beyond the French capital. But the amount of the toll suggested is so high that there would be little, if any, economy in providing a canal at all. It would be just as cheap to continue to break bulk at Rouen and follow the present practice of sending the goods on by the present small barges. So I hardly think the canal is likely to materialize at present, unless, indeed, it be found that its provision is the only way in which the flooding of the city can be prevented.

The Newhaven and Dieppe Route

is pushing ahead. One of the two railway companies interested in the steamship service is the Chemin de Fer de l'Ouest, which has within the last year or two been taken over by the French Government and has since afforded rather a fine object lesson as to the undesirability of nationalizing the railways of this country. But though the railway has now become a State department, it is pushing forward the development of its facilities and has recently had launched for it a new turbine engined passenger steamship for its Newhaven service. This vessel, which is the first of two sisters, was launched under the name of *Newhaven* from the Granville yard at Havre. She is to have a sea speed of twenty-two knots and will have altogether accommodation for a thousand passengers.

Sir Owen Philipps

continues to add to his ventures in shipping. The London and Thames Haven Oil Wharves, Limited, of which Company he is chairman, has just acquired the fleet of the European Petroleum Company, consisting of some five tank steamers. They are :—

	Steamer.	Year built.	Builders.	Gross tonnage.
1.	Baku Standard ..	1893	Armstrong's	3708
2.	Batoum	1893	Jas. Laing	4054
3.	Vedra	1893	Jas. Laing	4057
4.	James Brand	1893	Armstrong's	3907
5.	Broadmayne	1888	Palmer's	3120
			Total tonnage,	18,846

The Port of New York.

Whilst British shipbuilders are increasing the size and draught of Transatlantic steamships, the port of New York is endeavouring to improve the approaches to its harbour so that the new monsters may be able to dock with the minimum of delay. The Ambrose Channel is now reported to be about seven-eighths complete. It is now navigable at mean low tides for vessels drawing 37 ft. and going at a moderate speed, whilst it has a maximum high-water capacity of 44 ft. The aim is to give a minimum depth of 40 ft. over the whole channel.

The Thames River Service.

Those interested in the London County Council may find some consolation for the loss of its little paddle fleet by the study of the first annual report of the City Steam Boat Company, which was formed to continue the work which the Council was obliged to discontinue. The Company started under the best auspices. Its business had been boomed by the Council, and it was provided with a fleet of practically new vessels at about one-tenth of their original cost. Yet on its first year's working it shows a loss of no less than £1,728. This state of affairs is claimed to be due to the abnormally wet summer which London endured in 1910, and it is confidently expected that 1911, especially in view of the approaching Coronation, will tell a different tale and one much more acceptable to the shareholders. Though the vessels which were discarded by the County Council seem to have changed hands in the first place at something like £500 apiece, the buyers seem to have proved their value, for a re-sale of one of them has been reported at something considerably over £2,000.

The "Balmoral Castle,"

which, as a King's ship, sailed for South Africa with the Duke of Connaught and his suite on the 11th October, has fulfilled her mission to the satisfaction of all concerned. She left Portsmouth for Southampton, her home port, on the 3rd January, where she was at once paid off, the Royal Naval crew handing her over to her owners. She is appointed to take the sailing of the 18th February to South Africa with the mails. The advent of the two new mail steamers has enabled the Union Castle Company to provide twin-screw vessels for all its mail sailings, the *Carisbrook Castle*, latest and best of the single-screw vessels, going as reserve steamer. The two vessels formerly held in reserve were, of course, the *Dunnottar Castle* and the *Dunvegan Castle*. Of these the former has been taken on long charter as a public yacht by Sir H. S. Lunn, whilst the latter is now diverted into the

new service to East Africa *via* the Suez Canal, being appointed to leave Middlesbrough on the 21st and Southampton on the 27th January.

The agreement between the Union Castle Company and the Crown Agents for the Governments of the East Africa, Uganda and Nyassaland Protectorates and Zanzibar—whereon the new service *via* Suez is based—has now been published. The Company thereby undertakes to despatch a steamship at least equal to those with which it maintains its intermediate service, once in every four weeks. To enable it to do this and to overcome the difficulties caused by the Suez Canal tolls, the Government on their part undertake to give it all their Government passengers and emigrants at tariff rates, though power is reserved on emergency to send one or two passengers by other conveyance. Similarly the new service is to take the Government freight at agreed rates. But in urgent cases goods may be sent by other lines, whilst provision is made for the possibility of the Company's rates being higher than those of its competitors. The Governments concerned further undertake to do all they can to find homeward cargo for the steamships and to arrange for the carriage by them of the mails on both the outward and homeward voyages. The agreement is terminable by six months' notice on the part of the Crown Agents concerned.

The Elder Dempster Co.

has had two pieces of bad luck recently. There seems, in the first place, now little hope of the safety of their steamship *Axim*, which sailed from London for Las Palmas and the West Coast of Africa on the 9th December. It was at first hoped that the absence of news could be accounted for by the fact that for some reason she had failed to call at the Islands. But soon lapse of time negatived even this hope. Then came definite news which left no further room for doubt. The steamer *Elswick Manor*, arriving at Hamburg from Nicolaieff, reported that at 11 a.m. on Christmas Eve she passed the top of a wheel house and chart room surmounted with brass stanchions and rails. This was evidently from a steamer, and was identified with the missing vessel from the fact that it bore a plate with a builder's number—231—upon it. That number is the builders' number of the *Axim*. This was found in lat. 47 N., long. 6·30 W. Then it was announced that eight days previously in almost the same position as that in which the wreckage was found, the steamship *Egyptian Prince* sighted at five o'clock in the morning a steamer without lights blowing her whistle. The master of the *Egyptian Prince* answered the distressed ship, and put his own vessel head on to the heavy sea then running to await daylight. But when morning broke nothing was to be seen of the other vessel, though there was a little wreckage in sight. It may therefore be assumed that it was on the morning of the 15th December that the *Axim* foundered. She was built for the British and African Steam Navigation Co. in 1894 by the Naval Construction and Armaments Co., of Barrow, and was a steamship of 2,804 tons gross register. The other casualty was the stranding of the same Company's steamer *Montauk* at Sekondi on the 14th January. This vessel was built at Hartlepool in the same year as the *Axim*, her builders being Messrs. W. Gray & Co. She was of 4,040 tons gross.

The Gale of the 11th January

was one of remarkable violence. It disarranged the Channel service on the South-East coast of England and caused trouble to one of the finest of the Great Western Railway Company's turbine steamers on the Irish route. This was the *St. David's*, bound from Rosslare to Fishguard, where she should have arrived at about three o'clock on the morning of the 12th January. In point of fact she was not berthed till noon, having had her decks swept by the heavy seas and lost two seamen overboard. This event, sad though it was, would not have accounted for all the delay. But she lost her rudder and was unable to enter the harbour till the gale somewhat moderated. It is said that during the height of the storm the waves striking on the rocks and breakwaters were running to a height of a hundred feet. Fishguard is to have every facility for safe and rapid navigation. The Trinity House have just notified the fact that on and after the 8th March, approach to the harbour will be rendered easy by the institution of a submarine bell connected with a gas-lighted buoy three miles north from the lighthouse on the breakwater. At the same time there will be stationed at the Bishop Rock, Scilly Islands, a bell buoy with submarine bell, in order that a repetition of the *Minnehaha* accident may be prevented as far as is humanly possible.

Wireless Telegraphy.

A remarkable feat has been performed by the wireless operator of the Pacific Steam Navigation Company's t.s.s. *Oravia*, in conjunction with him of the Royal Mail liner *Aragon*. The former vessel was about 100 miles to the North of the Falkland Islands when a passenger handed in a message for Liverpool, shortly before midnight on the 9th January. The message was at once sent off, and duly picked up by the *Aragon*. By her it was re-transmitted and so it reached the African coast, whence it was sent on to the addressee. A recent paper has shown the advance of communication by wireless. What one year is exceptional next year becomes ordinary practice, and soon it will be taken as a matter of course that passenger steamships, wherever they may be, will be in continuous touch, either with other vessels or with land stations. Communication at the present time seems to be in process of being facilitated by various agreements which are being entered into by the wireless companies with one another and with the submarine cable lines.

The Mersey Docks and Harbour Board

have just issued a well-got-up and profusely illustrated volume, which gives a history of the development of their port from the earliest times, and of the genesis and construction of their world-famous docks and warehouses. The unrivalled facilities which Liverpool can now offer to the shipowner and merchant are thoroughly explained and catalogued. The book is interesting, not only to the commercial man but also to all those who value the British pluck and determination which have induced Liverpool men to spend so many millions on stone and concrete on their river banks, in the knowledge that they would see such an ample return for their labour and confidence.

The "Lusitania"

has made another excellent winter passage, reaching New York at 4 p.m. on Thursday, the 12th January, her time being 4 days 13 hours and 35 minutes, with a best day of 650 miles and a mean speed throughout of 25·37 knots.

REFRIGERATING APPARATUS FOR MARINE TRANSPORT.

(*Continued from page* 196).

Removing the Heat that Passes into the Cold Chamber.

It will be understood that it is not only important to lower the temperature of the produce, but also to keep it at the figure desired. If the temperature rises appreciably, any incipient germs that are present have a chance of multiplying, and the subsequent lowered temperature may not arrest their growth. The produce, when it is at the low temperature at which it is designed to be held, is inside a chamber, described below, that is specially arranged to prevent the ingress of heat from outside. In the case of frozen produce, for instance, there is a difference in temperate climates of some 43°F. at least, between the atmosphere outside and the air inside the chamber. In the tropics, as marine engineers know well, the difference may be as much as 80°F. or even 90°F. or more. Modern methods of construction of cold chambers have reduced the rate at which heat will pass into them, but even with the very best construction some heat is constantly passing through the walls, floor and roof or ceiling of the chamber, and it is the office of the refrigerating appliance described hereafter, to extract this heat, as fast as it is delivered, so that the temperature of the atmosphere surrounding the produce shall be maintained at the desired figure.

The Construction of a Cold Chamber.

All cold chambers, whether on board ship or on shore, are constructed on the same lines. They are virtually large boxes, or cases, having a skin of insulating material, a skin that will prevent or reduce the passage of heat through it. As marine engineers know, all substances conduct heat, but there is a great difference between the rate at which heat will pass

through different substances. The metals conduct heat most readily, and at the other end of the scale, there are a few well-known substances, such as cork, silicate cotton, finely divided flake charcoal, sawdust, wool and others, which offer a very high resistance to the passage of heat through them. The substances which offer the greatest amount of resistance to the passage of heat are always those that are divided up into minute cells or their equivalent. Cork, for instance, is a substance which grows upon certain oak trees that are found in Spain, certain parts of America and in other parts of the world. If a section of cork is examined, it will be found to consist of a very large number of very small air cells. Each air cell is bounded by a thin membrane. In passing through a mass of cork, the heat current has to pass through the membrane of each cell, across the minute quantity of air, thence through the membrane on the other side, through the air in the next cell, and so on. It may be mentioned that of all substances available as thermal insulators, still dry air is the very best. This is one reason why the substances named, in which there are a number of very small air cells, are such good insulators. In small bodies of air, such as exist in the minute air cells of cork, there can be no air currents, and no delivery of heat from one portion of the cell to another. Where there are large bodies of air, as marine engineers know, convection air currents are set up, causing a transference of heat from one point to the other. In the other substances mentioned, *viz.*, silicate cotton, flake charcoal, wool, sawdust, etc., there are the same phenomena of air cells. Silicate cotton, or slag wool as it is often called, is a substance made from the slag or dross that is run off from the iron smelting furnace, after the pig iron has been run into the beds. The slag is used largely for road mending. All sorts of utensils also are made of it, some more or less ornamental. It looks like a very vitreous stone, when viewed in masses. The slag is put through a process very similar to that of glass blowing. It is raised to a very high temperature, in a miniature blast furnace, and exposed to a blast of air. The result is the formation of a very beautiful mass of woolly looking material, which is received by a chamber provided for the purpose. If examined, the woolly looking mass will be found to contain minute globules that look like glass, and the whole appearance is very similar to that of spun glass. It contains the air cells mentioned in connection with the cork, the cells being interposed between successive fibres, as they may be termed, of the wool.

The holds, or cold chambers in which produce is to be carried, are protected from the ingress of heat from outside by a complete skin of one of the insulating materials mentioned, just as electrical apparatus is protected by electrical insulating materials. An important point in connection with the insulation of cold chambers is the prevention of the access of moisture to the insulating substance. Dry silicate cotton, cork and flake charcoal are all good insulators. If wet, all of them lose their insulating properties to a considerable extent. In building cold chambers on shore, the following is the arrangement. The building itself may be of brick, or stone, or even of wood. The walls are first lined with match boarding. Match boarding, it will be remembered, is made in large quantities for the purpose of putting up partitions quickly. It is known also as grooved and tongued boarding. One edge of each board has a groove, and the other edge a tongue. The tongue of one board fits into the groove of its neighbour, so that a continuous wall or partition is formed. The plating, as it may be termed, with match boarding of the outside wall is the foundation for the insulating wall. It is sometimes arranged to have a small air space between the outside wall and the match boarding. This is also to prevent the passage of the moisture that is always present in brick and stone walls from passing to the match boarding. The inside of the match boarding is protected by a layer of a special kind of paper that has been developed for the purpose. There are a number of papers on the market, the special characteristic of which is that they are waterproof, and not expensive. They are placed upon the inside of the match boarding, very much as a wall paper is placed upon the wall of a living room. At a certain distance from the outer plating of match boarding, another wall or plating of match boarding is fixed, supported by wooden uprights, the inner and outer platings of match boarding being separated by distance pieces secured to the uprights. The two surfaces of the match boarding face each other. The outer surface of the inner plating of match-boarding is also protected by a layer of waterproof paper. The space between the two platings of match-boarding is filled in with one of the insulating substances mentioned, silicate cotton, cork, flake charcoal, etc. It is important that the insulating substance should be well rammed down, and that the space between the two match-boardings should be quite full. There is a tendency, if the insulator is not well rammed down, for it to settle, and leave a space at the top, into which moisture may possibly enter. Figs. 1 and 2 show sections of walls of cold chambers. A modification of the arrangement where cork is used, is that the

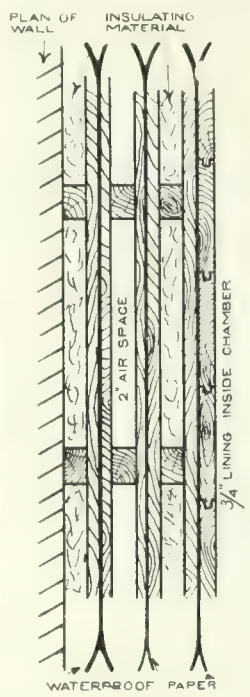


Fig. 1.

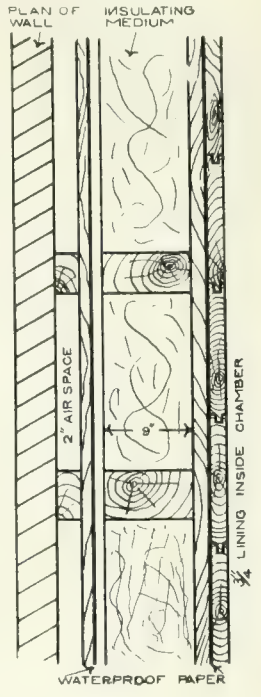


Fig. 2.

cork is fixed upon the outside wall of match-boarding in the form of bricks. The space between the two walls may also be filled with cork bricks. The floor and roof of the room are insulated in the same way as the walls, but with the necessary modifications, allowing of the floor being walked upon, and of the roof supporting fittings for the produce, etc. Fig. 3 is a section of an insulated floor. The distance between the two walls of match-boarding varies according to the conditions, the difference of temperature likely to be met with and the fancy of the engineer. The greater the thickness of the insulator the greater should be the resistance offered to the

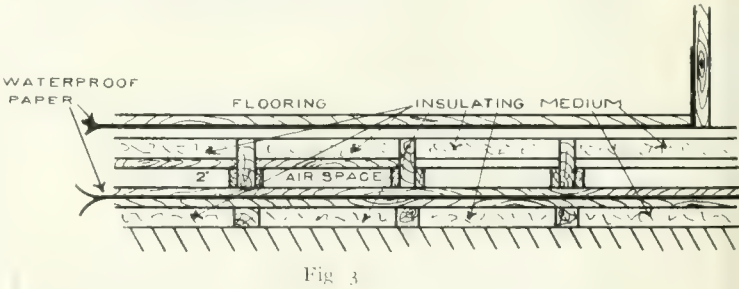


Fig. 3.

passage of heat through it. It is sometimes the practice to divide the space between the two outer walls of match-boarding into two, by uprights, and a thinner partition, the two spaces being packed with the insulator as before. The thickness of the insulator ranges from 4 in. up to 9 in. The question of economy largely rules the thickness of the insulator. The problem is solved by the old method of the balance sheet. The larger the amount of insulation, assuming that it is properly fixed and of the best quality, and arranged in the best

manner, the smaller is the quantity of heat leaking through it, and therefore the smaller is the amount of work to be done by the refrigerating plant. On the other hand, the larger the thickness of the insulation, and the more elaborate the general arrangement of the insulating walls, the greater is the interest upon the construction of the cold chamber. The engineer who is designing a cold chamber will, therefore, balance one against the other. Where coal is cheap, and other things in proportion, and where the difference of temperature to be dealt with is not high, the insulation may be small, and *vice versa*. It should be mentioned that in a few cases air insulation alone is relied upon. The double walls are built in the manner described, but not very far apart, and the space is divided up by uprights and cross pieces, so as to reduce the possibility of the circulation of air currents. An air space is also sometimes provided in the wall, as well as the insulation as shown in Figs. 1 and 2.

In board ship work, the holds are usually converted bodily into cold chambers. It is not wise to allow the skin of the ship to be also the outer wall of the cold chamber, and therefore the commencement of the wall of the cold chamber is usually a small space from the skin of the ship, an air space being provided between them, as mentioned above. The remainder of the arrangements are very similar to those on shore, provision being made for hatches, which must also be insulated.

(*To be continued.*)

THE HISTORY AND PRACTICE OF LUBRICATION IN MARINE ENGINES.*

By Mr. J. VEITCH WILSON.

THE two things which mainly trouble me, when asked to prepare a paper for the delectation of friendly critics, such as I hope are before me to-night, are, 1st, the selection of a subject, and, 2nd, the selection of a title. As far as the first difficulty is concerned, your honorary secretary saved me trouble by simply intimating that he wanted a paper on lubrication, leaving me free to choose the particular aspect of the subject with which I should deal. The title which he has placed in your programme is wide enough, in all conscience, for even the most ambitious essayist, so wide, as it seemed to me, that in order to prevent misapprehension or disappointment I have thought it better to define the subject which I propose to bring before you this evening as "The history and practice of lubrication in marine engines." I shall proceed to deal with these two aspects of the subject in the order given.

EARLY STEAM ENGINES.—In discussing this section of my subject I shall endeavour to deal with it from both the historical and the practical point of view, mainly, however, be it understood, with regard to lubrication, since, in regard to the engineering aspect of the subject, every one in this room is better and more intimately acquainted with it than I, as a mere amateur, can profess to be. Yet, although I do not venture to discuss engineering matters with you, I may be permitted to refer to various stages in the development of the steam engine in order to emphasize some points in regard to lubrication to which I desire to direct your attention.

B.C. 150-200.—I always think that the oil trade owes a debt of gratitude which has never been sufficiently acknowledged to Hero of Alexandria, who, 150 or 200 years before the dawn of the Christian era, founded the engineering and the mechanical trades of the world, for I fancy that in his simple revolving engine, with the small power at his command, lubrication would play an important part. It is difficult to suppose that, after Hero had shown to the world the power of steam, its value as a source of energy should be forgotten and its use abandoned, but history is silent on the matter for upwards of fifteen hundred years.

A.D. 1629.—The next reference which I find to the use of steam as a motive agent occurs in a paper on "Horseless Road Locomotion," which was read before the British Association in Liverpool in 1896, by Mr. A. R. Sennett, a distinguished member of the leading engineering, mechanical, electrical and other learned societies. In this paper Mr. Sennett says that "the first engine used for imparting rotary motion to other machinery was that of the Italian Branca and consisted of a sort of windmill, against the vanes of which a jet of steam was caused to impinge." This engine was introduced in 1629. We may assume that the bearings of this machine would also call for lubrication, and I therefore also regard Branca as a benefactor to the oil trade. The interesting thing to me in this connection is that, while we moderns are given to regard the turbine as at once the most novel and the latest thing in prime movers, the two engines to which I have referred were undoubtedly turbines, that of Hero being of the recoil or the reaction type, while that of Branca was unquestionably of the impulse pattern.

A.D. 1601-1667.—The honour of being the father of the modern steam engine is also, by many authorities, attributed to the Marquis of Worcester (b. 1601, d. 1667), who is credited with the invention, or perhaps more correctly with the re-invention of the steam engine. Unfortunately for the Marquis's claim to this distinction, no drawings or specification of his engine have come down to us, but, from his description of his device as "an admirable and most forcible way to drive up water by fire," I think that we shall not do him any injustice if we assume that his apparatus was one in which a vessel was filled with steam, which was condensed by the application of cold water creating a vacuum into which water rushed to be again expelled by the admission of steam and the repetition of the cycle of operations. In the Worcester engine we appear to have the prototype of the Pulsometer of the present day.

A.D. 1705.—The next notable step in the history of the steam engine was the introduction of the piston. This important integral member of the modern steam engine we owe to the French philosopher, Papin, whose name will go down to posterity as the inventor of the steam digestor and, more honourably still, as the inventor of the steam safety valve. About the year 1690 Papin constructed a working model of a steam engine, consisting of a cylinder, open at the end, containing a piston and a little water below it. The water was converted into steam by the application of heat, and raised the piston. The machine was allowed to cool, the steam condensed and the pressure of the atmosphere caused the piston to descend. The backward and forward motion was converted into rotary by means of a rack and pinion and ratchet wheels. Here, therefore, with boiler and cylinder in one, we have probably, as far as space is concerned, the most economical engine which it is possible to conceive. And, to my mind, the beauty of the Papin engine is that it afforded opportunity, if it did not actually call for, the use of cylinder oil.

A.D. 1697-8.—A few years later, Captain Savery, having doubtless the Marquis of Worcester's engine in mind, produced a modification and perhaps an improvement of that engine. The Savery engine, if we may apply the word "engine" to an apparatus which had no moving parts, at any rate achieved the distinction, denied to its predecessors, of being used to some extent in industrial operations, more particularly in the drainage of mines in Cornwall and Devonshire. The essential improvement in the Savery engines over the earlier types was the use of a boiler separate from the vessel in which the steam did its work. Still, as you will observe, the Pulsometer idea.

A.D. 1705.—Following closely upon Savery we come on the first, I had almost said first "true" engine in which all the essential elementary principles of the modern steam engine are to be found. I now refer to the engine jointly invented by Newcomen, Cawley and Savery in 1705. In this engine there was a separate boiler supplying steam to a separate cylinder, in which a tightly fitting piston was provided. Steam from the boiler was introduced to the cylinder under the piston, which was raised. When the piston reached the top of its stroke a jet of water entered the cylinder, condensing the steam and producing a partial vacuum. The pressure of the atmosphere on the upper side of the piston caused it to return to its original position at the bottom of the cylinder and the operation was continuously repeated. The piston was attached by a chain to one end of a walking beam to the other end of which were suspended, by a chain, the pump rods and buckets by which water was to be raised from a well. The weight of these helped to raise the piston, while the atmospheric pressure on the piston

* Read at the Institute of Marine Engineers on 19th of December, 1910. Chairman, Mr. James Adamson, Hon. Sec.

over the vacuum in turn raised the bucket with its charge of water. In this case it is certain that the tightly fitting piston would, of necessity, require lubrication of some kind. The two engines which I have just described, *viz.*, those of Savery and Newcomen, with others, in which the effective power was derived from the weight of the atmosphere upon the return journey of the piston, are generally referred to as "atmospheric engines," despite the fact that steam was the primary condition of their action.

WATT, b. 1736, d. 1819.—As it is possible that these elementary remarks of mine may fall into the hands of some chance reader, less familiar than you are with the early history of the steam engine, I hope that you will excuse me for occupying your time by referring to the part taken by Watt in the development of the steam engine. We have all heard in our school days of James Watt's birth in Greenock of respectable parents, of the boy's delicate health, of his education at home, of his sojourn in London to learn business, of his return to his native air on account of health, of his apprenticeship to a mathematical instrument maker in Glasgow, and of his start in business on his own account in that city. Next we learnt of the critical moment in his life when, a model of Newcomen's engine having come into his hands for repair, he discovered its defects and invented the remedies. How from the crude single-acting engine with cylinder and condenser in one he evolved the double-acting engine with separate condenser and added to its efficiency by the addition of a governor of his own invention. We are also familiar with the story and the picture of James Watt as a boy with his arms on his knees and his chin in his hands before the kitchen fire, studying the escape of steam from the jumping lid of the tea kettle and therefrom deducing the first idea of the mechanical power of steam upon which is founded the claim that James Watt invented the steam engine. The story is doubtlessly an apochryphal one as it has been shown in numerous treatises, and as I have briefly indicated above that steam had been employed as a power agent for centuries before Watt's birth. But while we cannot recognise Watt as the discoverer of the power of steam or as the original inventor of the steam engine, I do not think that I overstate the case when I say that in thus transforming the feeble machines of his predecessors into a practical engine Watt did more to shape the destinies and to promote the welfare of humanity than did Julius Cæsar by all his victories or Columbus by his discoveries. Since James Watt's days improvements and inventions relating to steam engines have poured upon the world in an endless never-ceasing torrent of patents filling acres of shelves in the Patent Office, the mere indices sufficient to stock a library. Of course, it would be as impossible as it would be incongruous, in a paper of this sort, to attempt any enumeration of these, but I hope that you will bear with me when, claiming one of the privileges of age, I tell you that it has been my good fortune to remember the old *Industry* which, built in 1814, was, according to Captain Williamson, the historian of the Clyde passenger steamers, the sixth steamer to be launched upon that river, the mother of steamships. Often and often have I stood on the custom-house quay, Greenock, in the evening and watched the good old boat as, with much puffing and blowing, and with paddles that seemed to come to a stop twice in every revolution, she started on her nightly voyage with her cargo of sugar for Glasgow. The last that I saw of the old boat was on the mud in Bowling Harbour and now I understand, that her engines rest in Kelvingrove Park, Glasgow.

Having now briefly and, I fear, somewhat imperfectly dealt with what may be described as the traditionary period in the history of the steam engine, I should like to deal in a similar manner with the early history of oils for which we may claim even greater antiquity than that which falls to the credit of the steam engine. I am bound to say that, until I began to look about me for material for this paper, I had not realized how scanty is the available information upon the early history of the oil trade. Oil manufacturers, oil dealers and oil users alike seem to be content to accept these useful products as they find them and care not to enquire whence or how they come to be there. To me it has always been a matter for wonder and amazement when and by whom, from such interesting but unlikely raw materials as those represented by the samples on the table, the highly refined and beautiful products with which we are all familiar were originally obtained. The same puzzle occurs with regard to the many articles of food which we daily consume with confidence and pleasure. Who first had the courage to try them and how many victims were there of misplaced confidence? I have ransacked all the dictionaries, encyclopædias and technical books in my own possession in vain. I have worried any and all of my friends who were likely to know anything of the matter. I have applied to the British Museum, but failed to find any references to the use of lubricants earlier than the first half of the nineteenth century. Finally, through the kindness of a friend I got into touch with Dr. Bradley, who is associated with Sir James Murray in the production of the great new English Dictionary, and from him I obtained a number of classical references to the use of lubricants. I quote some of these, with the years in which they were used.

1462, "hys fellow schall greese ye bellys and fynde greese therto."

1530, "He greaseth his carte to make it go the better."

1598, "To annoynt and grease the axle-trees of the carriage."

I give you one more, this time in a poetical form, from Cowper's "Progress of Error."

1780, "The carriage bowls along and all are pleased
If Tom be sober and the wheels well greased."

These dates, however, from my point of view, are all comparatively modern, being all "A.D.", while it was my desire to find references not in later centuries of the Christian Era, but in the earliest centuries of the history of the world. So I next turned to my copy of that ancient historian of the Jews, Flavius Josephus, and although I failed to find in his records any reference to the use of oil as a lubricant, I was interested in learning that oil monopolies are no such new things as we moderns are disposed to imagine, for I find this story of a certain "John" who had been engaged in repairing the walls of his native city (Gischala) that, with a view of raising money, "He contrived a very shrewd trick, and pretending that the Jews who dwelt in Syria were obliged to make use of oil that was made by others than those of their own nation, he desired leave of Josephus to send oil to their borders; so he bought four amphoræ with such Tyrian money as was of the value of four Attic drachmæ and sold every half amphoræ at the same price; and as Galilee was very fruitful in oil, and was peculiarly so at that time, by sending away great quantities and having the sole privilege to do so he gathered an immense sum of money together," apparently the sort of transaction to which we should apply the term "trust" or "corner." Josephus having failed me I turned to the "Old Testament" in which, with the help of Cruden's Concordance, I found numerous references to the subject in which we are interested, *viz.*, oil. These, however, mainly apply to the use of oil for sacramental and domestic purposes. The first occurs in Gen. xxvii. 18 (about B.C. 1760), "and Jacob rose up early in the morning and took the stone that he had used as a pillow and set it up as a pillar and poured oil upon it." I next bethought me that, as chariots are frequently referred to in sacred writ, I might find some reference to the use of oil in connection with these. References to chariots I did find in Gen. xli. 43 (about B.C. 1715), "And he made him ride in the second chariot which he had," and again in Exod. xiv. 25 (about B.C. 1490), referring to the passage of the Red Sea, "And they took off the wheels of their chariots, so that they drave heavily." There is no reference to the use of oil, or of any other lubricant, in either of these cases, but as we have ample evidence that, in these ancient days they were familiar with oil (probably olive oil) for sacramental and domestic purposes, we may assume that they were also acquainted with tallow or suet which they would obtain from the flesh of animals in the preparation of their food. We may also assume that, whether the axles of their chariots were made of wood or of iron, there would be a terrible squeaking and they would "drive heavily" unless some unguent were applied. Nor would they have far to seek for what they required, since, as we have already seen, they were acquainted with olive oil, probably with tallow and, some centuries earlier, with petroleum, perhaps under some other name, such as pitch or bitumen, for we learn from Gen. vi. 14, that about three thousand three hundred years B.C. Noah was told to build an ark and to "pitch it within and without with pitch." Again, in Gen. xi. 3, in reference to the building of the tower of Babel, we read that "they had bricks for stone and slime had they for

mortar." Next we find reference to the origin of this slime in Gen. xiv. 10, where it is said "And the Vale of Siddim was full of 'slime pits'" by which from the manner in which petroleum has been found in later days in the eastern hemisphere it is permissible to suppose that natural petroleum wells are referred to. In further proof of the antiquity of petroleum we find in Deut. xxxii. 13, that "he made him much oil out of the dry rock," evidently some kind of pumping well, and again in Job xxix. 6, where Job says, "and the rock poured me out rivers of oil," suggesting that they had in these days what we now describe as "gushers." From this it would appear that, even in these patriarchal times, they had at their disposal animal, vegetable and rock oils and were thus almost as well provided with materials for lubrication as we are after a lapse of 5000 years. Doubtless, although we have no record of the fact, they had ways and means of preparing from these crude materials suitable oils for use in the sanctuary and for cooking, for lighting and for lubrication, and I conceive it probable that these duties devolved upon oil merchants who would have their own notions regarding the best blends and brands for all possible purposes and conditions, just like some of their successors of the twentieth century. That the knowledge and use of these natural earth oils, by whatever name, slime, bitumen or pitch, they were called, was not limited to the Holy Land is shown by the fact that, when Moses' mother prepared the ark of bulrushes for the child's reception, "she daubed it within and without with slime and pitch," proving that these materials were known and used in Egypt in the days of the Pharaohs, as in the process of embalming.

Turning to other history we find, according to Herodotus, that the Zoroastrians, or Persians, about 450 B.C., worshipped the eternal fires which they found in the neighbourhood of the Black Sea. It is assumed that the flames which they viewed with superstitious awe proceeded from some natural gas escaping through a fissure in the rocks or from some little petroleum spring oozing through the surface of the ground and accidentally ignited. This probably happened on the peninsula of Apsheron on the Caspian Sea, but the commercial value of the wells was not realized till the 13th century, and they then became the subject of much fighting for their possession on the part of Persians, Armenians and Russians, the victor for the time being taking the wells and their produce for his reward. After many changes of owners, the coveted prize finally (about 1801) fell into the hands of the Russians, who still hold it. It is certain, however, that, in addition to the well-known oil regions in America, oil has been found in large quantities in Burmah, in China, in Japan and in other eastern countries, and now petroleum is found in Russia, in Galicia and in several other adjoining countries in eastern Europe.

It has always appeared a mystery and a misfortune to me that the authors of the many excellent technical works which have been published upon oils have contented themselves by describing the origin, the properties and the uses of the oils they refer to, but have told us nothing of the history of these products. I have, however, been doing a little research on my own account by dipping into the records of the Patent Office, and although there is not time to go exhaustively into the matter this evening, I think that you will be interested in some of the information which I have obtained. I therefore mention a few. In 1637 A.D., Thomas Tookey was granted a patent for "The sole making of lamps and of an engine and mill for the cheape and speedy making of oyle for the use of lamps and otherwise." Nothing is said of the material from which Mr. Tookey proposed to make his "oyles." In 1694 we find a patent granted to Ecle, Hancock and Portlock for "A way to extract and make great quantities of pitch, tarr and oyle out of a sort of stone." This seems to be the earliest reference which we have to mineral oil. In 1716 a patent was issued to Talbot Edwards, who claims "the sole making of pitch, tarr and oyl," but, while admitting that such things have been formerly attempted "from rock or roofe stone by breaking, grinding and boiling the same," explains that his "new and better way is by fluxing with fire only." Now as shale is frequently, if not always, found on the top of coal it seems evident that some sort of shale is referred to in this specification, while the method of "fluxing by fire" plainly points to the use of some fore-runner of the retort of the present day. The next specification is still more interesting and definite. It was granted in 1742 to Michael and Thomas Betton for "An oyl extracted from a flinty rock, for the cure of rheumatick and scorbutick and other cases." The patentees go on to say that "the black pitchy flinty rock, which is commonly found lying next and immediately over the coal in coal mines, is first powdered and put into a furnace covered down close with a head to it and worked with fire which will extract the said oyl from it." I pass over several other specifications in somewhat similar terms and come to the epoch-making patent of the Earl of Dundonald, who was eminent alike as a naval commander, a politician and a man of science. To this gentleman is due the credit of having, by his patent, No. 1291, of 30th April, 1781, demonstrated how "tar, pitch and essential oils might be obtained from pit coal." He describes the apparatus in which the process is carried on, the method of internal firing without the use of any other fire, the process of distillation and of condensation, all in terms which might be applied to the methods of the present day. It would be of little interest to enumerate all the many patents which follow those to which I have called your attention and I leave them without further remark.

ANCIENT FATTY OILS.—While we have many admirable technical books in which the raw materials from which oils are obtained, the methods of their manufacture and their properties are fully and carefully set forth, none of the writers with whom I am acquainted has given us any account of the introduction or of the early uses of these oils. It may seem rather presumptuous on my part to attempt to make good the deficiencies of these authorities, but my curiosity tempted me to look up some of the old patent records and as the information which I obtained interested me and may interest you, I bring some of it before you. The records of our Patent Office begin with the year 1617 A.D., but many of the specifications to which I am going to refer appear to be re-introduced and were in use for the production of various oils.

A.D. 1617.—The first oil patent on record is one granted to John Wolfen and John Miller in November, 1617, which, on account of its quaintness, I quote in full, for "A certayne oyle or composicon of oyles wherewith to keep armors and armes from rust, canker, or the like meanes of perishinge or decay, farre exceedinge the ordinary wayes or meanes nowe or heretofore vsed in that behalfe," all which reads very much like an intelligent anticipation of Price's Rangoon oil of the present day.

A.D. 1624.—The first vegetable oil to which I find a reference is "Rape." This patent was granted to Benedict Webbe in December, 1624, for "A kinde of oyle to be made of rapeseede and other smalle round seedes, for the vse of clothing, and vppon manie chargeable trialls . . . hath now att last attained to the p'fect art and skill of making the said oyle of rapeseede and other smalle seedes aforesaid which oyle vppon trialle thereof by manie clothiers of our counties of Wiltes, Gloucester, and Somersett, is found far better for the vse of clothing than that which hath beene yeerely brought out of the low countries, and as usefull as the Spanishe oyle yeerely imported into this Kingdome of England, and bought att deare rates and prices for the vse of the finest sortes of clothes." Here, therefore, we have it on record that English rape oil, oil from the "low countries," doubtless rape oil, and Spanish oil (olive oil) had been used by English woollen manufacturers anterior to 1624.

A.D. 1636.—Next in the long procession of patents we come upon one granted to Edward Biddle and Thomas Osbaldstone in 1636, for the extraction of tallow and oil frome bones. This sets forth, in the curious phraseology of the times, "a newe waie, not heretofore vsed of drawing out and extracting the tallows or liquid substance of the said bones to the generall good of our subjects, as well in bringing downe the excessive price of tallowe . . . or liquide substaunce soe to be drawne out . . . alsoe giving vs to vnderstand that the offil of the said bones may notwithstanding be employed to manie good purposes besides."

A.D. 1673.—A patent was now granted to Lewis Bayley for "A mill for grinding of rapeseed and lynnseed, with a presse to produce ye oyle of the same, and alsoe for ye grinding of Brazile wood, logwood and other hard woods and things grindable, which mill workes a new way without stones."

A.D. 1713.—Now what do you think of beech oil? Well,

Mr. Aaron Hill in 1713 declares "How from a certain good and wholesome vegitable, of the growth of Greate Britaine, might be expressed a sweet and wholesome oyle not hitherto known or discovered in this kingdome. This is obtained by expressing the fruit or seed of the beech tree." Beech nut oil, although we do not hear much about it, is still an article of commerce and is used, in France, for salads, for burning in lamps and for making soap.

A.D. 1734.—A few years later and we find the first mention of lard oil. This occurs in 1734, when a patent was granted to Samuel Simpson for "A method for extracting an oyle or grease from the flesh of swine, which will be as usefull as any foreign oyl in the woollen manufacture, and sold at a much cheaper rate and also an encouragement for the increasing breed of swine and thereby afford a large quantity of manure."

A.D. 1744.—Ten years later we find a patent granted to Nicholas Belli and Anthony Gualterai (1744) with much wealth of detail for "working a vegetable extraordinary productive of oyl of a sweet taste, fine colour, wholesome and of great use, especially in the manufacture of wool. Rich tallow land is to be plowed, then dressed with good stable dung and sewn with "the seed called sesamo, mixed with fine dry mould, about four pounds to an acre." This oil under various names, Teel Oil, Benne oil or Sesame oil, still occupies the position of one of our standard oils, and the fact that it is recognised as a substitute for olive oil shows that our ancestors were good judges of oil when they recommended "Sesamo" for use on wool. Those patents to which I have already called your attention have mainly been for the mere production of oils from various materials, and it has struck me in reading them, as it has doubtless also struck you, that they all refer to *new ways* of obtaining oils, which is a clear indication that the production of these oils was by no means a new thing, but had been practised for generations or it may be for centuries.

A.D. 1748.—This is confirmed by the next patent to which I refer. This was granted to Daniel Bridges in 1748, for a new way of refining oil. Bridges' claim is for a "new method to refine, purify and meliorate an oyl extracted from rape seed commonly called rape oyl, to a far greater perfection than ever known before,etc." Bridges' method was the use of oil of vitriol or sulphuric acid, and is the basis of the systems in use at the present day. This same gentleman turns up a few years later as the patentee of a new method for making sperm candles.

A.D. 1754.—I trust that you will not regard me as guilty of abusing your patience if I refer to one more patent which serves to amplify the list of oils which our forefathers were acquainted with, and confirms my statement that these early patents were modifications of processes previously in use. The patent which I now refer to was granted to Peter Zomer for "A method of extracting and making from the tails and fins of whales, and from such sediment, trash, etc., etc., as were usually thrown away, a sort of black 'train' oil." My interest in this patent consists in the evidence of the early use of the name "train," as applied to whale oil.

Coming to modern times, I hope that the southerners among my audience will not think me guilty of inordinate vanity when I claim that to a Scotsman is due the inception and the inauguration of the petroleum trade of the world. In 1847, Mr. James Young, a Glasgow man, had his attention drawn by Dr. subsequently Lord, Lyon Playfair to a small petroleum spring in Alfreton, Derbyshire. Mr. Young leased the spring and refined the products but as the spring became exhausted in two or three years, Mr. Young, having in mind, no doubt, Lord Dundonald's and Mr. Murdoch's efforts in producing gas from coal, directed his attention to the discovery of some material from, and a method by which liquid hydrocarbons could be artificially produced. That material was found in the Boghead or Torbanehill mineral, of which considerable deposits were found near Bathgate in Scotland. This mineral, when gently heated in retorts similar to those used in the manufacture of gas, yielded from 100 to 130 gallons of oil per ton, or nearly half the weight. Similar material (the question whether it should be called coal or not gave rise to a great law-suit which extended over many years) was found in the "Albert" mineral in North America and in some of the Australian coal measures. Having arranged for a supply of Boghead, Mr. Young took out his first patent No. 13992, on 17th October, 1850, which may be regarded as inaugurating the paraffin and the petroleum industry of the world. I say also the petroleum trade, because Mr. Young, being in possession of the master patents, granted licences to various firms in America and elsewhere for the production of oil from shale, coal and oil. It therefore remains a historical fact that the first mineral oil produced in America was so produced under Mr. Young's patent and licence. It may also be of interest to mention that, before the discovery of petroleum in America, paraffin oil had been sent in considerable quantities from this country to America. Strange as it may appear to you, it was also the case that, before the inauguration of the American petroleum trade, refined petroleum was also sent from this country to America. Among the first countries in the world in which petroleum was worked on a commercial scale was Burmah, the source of Rangoon petroleum. The value of the oil had been appreciated and various attempts had been made to refine it. A successful process had been invented by Mr. Warren De La Rue in 1853. The patent was acquired by Price's Patent Candle Company, who sent agents to Burmah to arrange for regular supplies of crude oil. This was shipped to England, where it was refined by the Candle Company and several valuable products were obtained. These included wax for candle making, and oil for lubrication and for illumination. Price's Patent Candle Company were, therefore, the first to import and the first to refine petroleum in this country, and in the first half of 1859 they shipped upwards of ten thousand gallons of this refined petroleum to America, but the discovery of petroleum in the United States in that year put an end to this trade. For many years before this date petroleum had been known among the Indian tribes of North America, who used it mainly for medicinal purposes. Latterly it had attracted the attention of speculators and on the 28th August, 1859, Colonel Drake, who had been prospecting in Venango County, Pennsylvania, struck oil at a depth of 33 feet. Oil having been located in this way, numerous other wells were sunk in the neighbourhood and the petroleum industry of the United States, which was destined to revolutionize the oil trade of the world, was launched upon its marvellous career.

(To be continued.)

Messrs. Leonard Chapman & Co., Ltd., Importers and Manufacturers, Munton Road, London, S.E., report:

Graphite, as imported, according to quality.

	£	s.	d.	£	s.	d.	
Ceylon L.L. c.i.f. London	16	5	0 to	38	10	0	per ton
.. O.L.	11	9	0 to	38	9	6	..
.. chips	9	5	0 to	28	0	0	..
.. dust	9	10	0 to	25	0	0	..

Purified, milled and ground.

Ceylon, 97% to 99%, f.o.b. London	59	0	0 to	63	0	0 per ton
.. 90% to 91% ..	40	0	0 to	42	0	0 ..
.. 80% to 81% ..	30	0	0 to	32	0	0 ..
.. 70% to 71% ..	27	0	0 to	28	0	0 ..
American, large flake, f.o.b. London	45	0	0 to	49	0	0 ..
.. small ..	35	0	0 to	45	0	0 ..
Joint Compd. per cwt.	2	9	0 to	2	12	6 ..
Paint Paste	2	2	0 to	2	5	0 ..
Paint per gall.	0	4	0 to	0	5	3 ..

Wholesale lists of tinned goods on application.

THE "PARAGON" PROPELLER.—An interesting demonstation of a new form of propeller for marine and river craft was recently given at Richmond before a party of Admiralty and other experts. The propeller is the invention of Mr. L. Vojacek, and it is being introduced into this country by The "Paragon" Marine Propeller Co., of 11, Bush Lane, London, E.C. A feature of the propeller is that the direction of the boat to which it is fitted can be altered without reversing the engines, and as the steering is done by a propeller instead of a rudder the movements of a boat so fitted are more closely under control and, therefore, quicker in action than the ordinary rudder, as was demonstrated at the time. The inventor claims that the device is equally applicable to large or small vessels. Our readers are referred to the October issue of *The Marine Engineer and Naval Architect*, where further particulars and illustrations are given of this propeller in an article entitled "The Internal Combustion Engine."

List of Vessels Launched in 1910.

(Continued from page 230.)

ENGLISH.

J. G. Fay & Co., Southampton.

Name of Vessel.	Built of	Owners.	G.T.	G.T. inclu. erect.	I.H.P.
3 Vessels	Wood		57		

FRENCH.

Schneider & Co., Creusot.

Name of Vessel.	Built of	Owners.	G.T.	G.T. inclu. erect.	I.H.P.
Submarine SC1	Steel	—	—	300	720
2 Lighters	,,	La Paloma	—	200ea	—
2 Lighters	,,	,,		300ea	—
WORK ON HAND.					
Submarine SC2	Steel	—	—	311	
Submarine SC3	,,	—	—	311	—

GERMAN.

"Weser" Actien Gesellschaft, Gropilingen, Bremen.

Name of Vessel.	Built of	Owners.	G.T.	G.T. inclu. erect.	I.H.P.
† Perseus, Andromeda, Phœbus, Bacchus, Najade and Nixe	Steel	Bremen	658ea		1,058
WORK ON HAND.					
Thuringen Nos. 171 & 174	Steel	Wilhelmshaven	—	—	—
m No. 175	,,	Bremen	100	—	250
† No. 176	,,	Hamburg	3,000	—	1,700
† No. 177	,,	,,	2,850	—	1,550
† No. 178	,,	Bremen	5,000	—	2,300
† Nos. 179, 180, 181 and 182	,,	,,	658ea	—	1,500ea
m No. 397	,,	,,	—	—	—

JAPANESE.

The Kawasaki Dockyard Co., Ltd., Kobe, Hyogo.

Name of Vessel.	Built of	Owners.	G.T.	G.T. inclu. erect.	I.H.P.
Shintoku Maru, Trawler	Steel	Kobe	215	—	550
Darichi Miyajima Maru and Daini Miyajima Maru, Tugs	,,	Ujina	56ea	—	150ea
Nanzan Maru, Barge	,,	Dairen	459	—	280
Hokuto Maru, Tug	,,	,,	62	—	250
Yebesu Maru, Trawler	,,	Kobe	214	—	550
† Daiun Maru, Cargo Boat	,,	,,	2,950	—	1,000
Not yet named, Bucket Dredger		Miye	300		300
Depositing Dock	,,	Kobe	2,300	—	—
Floating Dock	,,	Ujina	650	—	

WORK ON HAND.

One 4,950-ton Second-class Cruiser for Japanese Navy, one 8,000-ton cargo steamer, one 780-ton gunboat, one 375-ton destroyer, one set of Curtis marine turbines for a battleship for the Imperial Japanese Navy and ditto for a Japanese second-class cruiser.

The Ailsa Craig Motor Co., Ltd., of Chiswick, report that the most noticeable feature in their business of marine motor work in 1910 has been the increasing use of paraffin fuel instead of petrol, 90 per cent. of the Company's output now consisting of motors using the heavier oil. They further report that prospects for 1911 are most favourable.

Messrs. D. Ramsay, Smith & Co. inform us that the past year has brought them many orders for marine propellers of the solid and reversible bladed type.

Messrs. J. W. Brooke & Co., Ltd., say that 1910 has been a particularly satisfactory year so far as orders, output and general business are concerned, showing an increase over the 1909 output of over 70 per cent., and to deal with this large increase their factory has had to be considerably enlarged.

Geipel's Steam Traps.—We are informed by Messrs. Wm. Geipel & Co., Vulcan Works, St. Thomas Street, London, S.E., that during the past year their business in steam traps has shown a substantial increase, particularly in the "Rapidity" type that is now rapidly replacing the older type.

The above arrived too late for our January issue.

† Triple. *m* Motor.

THE STURROCK BOILER FURNACE BRIDGE.—This special fitment to the furnaces of marine and land boilers grows in favour wherever it is adopted; and we have before us a list of between 400 and 450 steamers whose boilers have been fitted with it. The year 1910, indeed, was a record year, and the makers, Messrs. The Sturrock Patent Bridge and Engineering Co., Reform Street, Dundee, report that the orders on hand at the close of the year numbered fully double what they had ever done at the same time in any previous year. Reports from many quarters are received testifying to the highly satisfactory results obtained from the adoption of the bridge in marine and land boilers, and to the admirable way in which it meets all the objects for which it was introduced. These, it may be shortly stated, were to provide at moderate cost a bridge wall which should be indestructible, could be easily removed and replaced without sacrifice of the material comprising it, and which should assist in the perfect combustion of the fuel in the furnace, and also act as a smoke consumer. Composed of cast iron bars with suitable air openings between, and with air openings through the bars at the crest of the bridge, highly heated air is admitted to mingle with the gases from the furnace, as they pass into the combustion chamber, thus effecting their complete combustion and preventing smoke. The bars never reach fusing point, do not burn or twist, and no clinker ever adheres to them. The whole bridge wall can be taken down to admit of examination in all parts of the furnace, and be as easily replaced without destroying any part, thus effecting a great saving in comparison with bridge walls of brick and fire clay, and doing away with all corrosion of the furnaces, which always takes place under the brickwork.

REVIEWS.

Les Flottes de Combat en 1911. By Commandant de Balincourt. Francs 5. Paris and Nancy: Berger Levrault et Cie.

With the commencement of a new year there appears the annual edition of this excellent book, brought thoroughly up-to-date and containing particulars of the world's navies and details of the latest additions thereto. The notable feature in the construction of warships during the past year has been the general advancement in size and displacement, 27,000 tons now being pretty general, and a displacement of 32,000 tons is being anticipated in several countries. Turbines are also to be found in the more recent ships. An increased thickness of armour follows the increase of tonnage with heavier armaments carried, it being noted that England has been the first to carry guns with 13·5 ins. bore. The new vessels of the battleship class, now completing or building, to be added to the British fleet are the *Neptune*, *Colossus* and *Hercules*, whose tonnage is stated at 20,600 tons with ten 12-inch guns in five turrets. These vessels are fitted with turbine engines to give a speed of 21·8 knots. Also the *Orion*, *Monarch*, *Conqueror* and *Thunderer*, with a displacement of 22,800 tons and turbine engines to give a speed of 21 knots. These battleships are armed with ten 13·5 guns in five turrets, all arranged axially, and have two funnels. Amongst the armoured cruisers the *Lion* and the *Princess Royal* are listed, having a displacement of 26,773 tons, with turbine engines of 70,000 horse-power, giving a speed of 30 knots, and having eight guns of 13·5 inches diameter in four turrets in the line of the axis of the vessel. Germany has some six additions to her ironclads of a displacement of about 21,500 tons, fitted with turbines having a speed of about 20 knots and armed with 11-inch guns. As the latest in armoured cruisers in Germany, we find the *Von der Tann* and the *Moltke*, of 19,000 tons displacement with a speed of 27 knots, and carrying eight guns of 11 inches in diameter. In the United States of America the new vessels are the *Arkansas* and *Wyoming*, with a displacement of 26,416 tons with turbines making a speed of about 21 knots and fitted with twelve guns of 12 ins. in diameter, arranged in six turrets placed axially. In France the only addition appears to be the two ironclads *Courbet* and *Jean Bart*, with a displacement of 23,467 tons, provided with turbines for a speed of 20 knots and armoured with twelve 12-inch guns in six turrets, not arranged axially. In Brazil it is to be noted that the latest additions are the *Mina-Geraes*, the *San Paulo* and later the *Rio de Janeiro*, of which the first two have a displacement of 19,813 tons, with an armament of twelve guns of 12 inches in diameter, and the last is to be of 32,000 tons with twelve guns of about 14 inches.

The "Practical Engineer" Pocket Book and Diary, 1911. Cloth, price 1/- nett; leather 1/6 nett. London: The Technical Publishing Co., Ltd.

The "Practical Engineer" Electrical Pocket Book and Diary, 1911. Cloth, price 1/- nett; leather 1/6 nett. London: The Technical Publishing Co., Ltd.

These pocket books, published at a low price, are excellent value for the money, and that they are appreciated is proved by the regularity of their appearance year by year. They are full of information necessary to the engineer, and should be in the hands of all those concerned. With regard to the first named it was considered a few years back that at 600 pages the limit in bulk had been reached, but the present edition is enlarged to 702 pages, with a diary in addition. The information is up-to-date, and all obsolete matter has been done away with. The new matter comprises notes on stoker systems, calorimeters, fuel economisers, thermal storage, superheaters, bearing pressures, recent practice in ball and roller bearings, cup leathers, chain drivings, the magnetic clutch, pyrometry, pneumatic tools, etc. The revision of the book has been extensive and affects many articles.

The Electrical Pocket Book has been greatly revised, caused by the progress made in connection with electrical engineering during the preceding twelve months. The article on the dynamo has undergone revision by Mr. C. C. Hawkins, M.A., and among other alterations and additions which appear are notes on the Ward-Leonard, Ilgner and Westinghouse rotary converter equalizer systems; balancers and boosters, metallic filament lamps, etc. A re-arrangement of wire tables and a synopsis of the 1909 Electric Lighting Act is also included.

Each volume contains at the end a diary on ruled section paper.

Official Year Book of the Scientific and Learned Societies of Great Britain and Ireland. Price 7/6. London: Charles Griffin & Co., Ltd.

This volume is the twenty-seventh annual issue and contains a record of the work done by the numerous scientific and learned societies and Government institutions of Great Britain and Ireland during the session 1909-1910. The work is compiled from official sources, and forms a most efficient and handy medium whereby to glean information as to the work done in science, literature and art throughout the session named. To the scientific worker and those engaged in literary work the volume will prove to be of great value, giving as it does a brief résumé of the subjects which have been brought before the societies during the past year. It follows, therefore, that the year book, first published in 1884, forms an excellent series of works of reference from that year to date on the matter of the work done by the organized institutions.

The "Mechanical World" Electrical Pocket Book and Diary for 1911. Price 6d. nett. Manchester: Emmott and Co., Ltd.

In this annual, comprising in all 271 pages, considerable improvement has been effected. The descriptive matter has been condensed and a large number of new tables inserted, for instance, cables of current densities, permissible temperature rise, percentage losses in electrical machinery, units of illumination, current consumed by incandescent lamps, etc. The book has also been thoroughly revised and many new illustrations introduced. The Pocket Book should find a ready sale at the small price it is published at.

BOOKS AND CATALOGUES RECEIVED.

Applied Mechanics and Mechanical Engineering. By Professor Jamieson. Vol. I., Applied Mechanics. Eighth edition. Price, 6s. London: Charles Griffin & Co., Ltd.

Steam and Steam Engines, including Turbines and Boilers. By [illegible] Jamieson. Vol. I. Seventeenth edition. Price, [illegible] London: Charles Griffin & Co., Ltd.

English Prices with Spanish Equivalents. Calculated at seven rates of exchange in Pesetas per kilogramme, giving rate per lb. and equivalents per ton. By S. Lambert. Price, [illegible] London: E. & F. N. Spon, Ltd.

Rhodes' Directory of Passenger Steamers, 1911. Price, 2s. 6d. London: George Philip & Son, Ltd.,

The Royal Navy List and Naval Recorder. January, 1911. Price, 10s. London: Witherby & Co.

Messrs. Siemens Bros. Dynamo Works, Ltd. Catalogue of "The Engineer's Switch."

Calendars have also been received from the following firms:—Messrs. The United States Metallic Packing Co., Ltd., Bradford; Messrs. The Welin Davit and Engineering Co., Ltd., London; Messrs. The Atlas Metal and Alloys Co., Ltd., London; Messrs. Frank & Sons, marine photographers, South Shields; and a useful combined almanac, desk diary and blotting-pad from Messrs. Alfred Graham & Co., makers of patent loud-speaking naval telephones.

Smooth-On Iron Paint.—The Smooth-On Manufacturing Co. have just issued a twelve-page booklet describing the latest Smooth-On product. Repeated requests for an iron paint that would be of the same high order as the Smooth-on cements have caused the Company to place upon the market a paint which they state will be more than a mere covering, but a paint that will permeate the pores of the iron or steel and adhere tenaciously to the surface, making a lasting protection to the metal. The Company claim to have produced a perfect iron cement which will be known and sold as "Smooth-On Iron Paint." Any subscriber desirous of learning more about this paint should write to the above Company at 572-574, Communipaw Avenue, Jersey City, N.J., U.S.A., for a twelve-page booklet.

ANSWERS TO CORRESPONDENTS.

W. J. DORAN, Melbourne.—The *Richmond Hill*, launched in the year 1883 by Messrs. Henry Murray & Co., Dumbarton, for Messrs. The Twin-Screw Steamship Line of Liverpool, was acquired in 1897 by the Allan Line and the name altered by them to the *Roumanian*. In 1898 she was taken over by the United States Government, and so far as can be traced, there are no records in this country of the new name then given to her, or what has become of her since that time. Messrs. James Howden & Co., Ltd., were the contractors and makers of the engines.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our Own Correspondent.)

Resumption of Activity.—The amount of fresh tonnage placed with Clyde builders since the lock-out was declared, on September 2nd, including the notable orders secured by Messrs. John Brown & Co., Clydebank, from the Cunard Co. for a vessel of unsurpassed dimensions, and that by Messrs. Scott's Shipbuilding and Engineering Co., Greenock, for an improved "Dreadnought" for the Admiralty, comes to approaching 260,000 tons; about 48,000 tons of which consist of warship work. Apart from the work presently on the stocks—and this of itself is much beyond the normal owing to the period of stoppage—the work booked constitutes almost nine months of brisk activity for the working forces of the Clyde shipyards, engine-shops, and subsidiary industries. The natural complement to this healthy state of things, both as regards work to do and smooth working arrangements, is increased remuneration to the workers; and here again the situation has been met by amicable conference and mutual concession. At a conference held in Edinburgh, on January 12th, between the Executive Board of the Shipbuilding Employers' Federation and the Standing Committee of the Shipyard Unions, it was agreed that the wages of all members of the unions should be advanced in the middle of February by 1/- per week, or ½d. per hour on time rates and 5 per cent. on piece rates, and that at the same time Clyde joiners' wages should be advanced in addition by half this amount. It was also agreed that the members of all the unions should be asked to vote on the question of accepting the new supplementary agreement, except the members of the Boilermakers' Society, who have already done so.

Naval Ship Launches.—The *Conqueror*, which is on the stocks at Messrs. Beardmore's establishment at Dalmuir, would have been launched in the first month of the year had it not been for the strike; but it will probably be April before the event takes place. It is interesting to note that Messrs. Beardmore & Co., at their Parkhead Works, have produced a considerable share of the material entering into the construction of the *Thunderer*, due for launching from the yard of the Thames Ironworks Co. on February 1st. Plates, castings and parts of forgings for the machinery have been produced at Parkhead; so that in the honours which Thames workers so earnestly claim for the production of the *Thunderer*, some little share falls to the West of Scotland.

Messrs. William Denny & Bros., Dumbarton, have received an order from their steady customers, Messrs. Patrick Henderson & Co., Glasgow, for a steamer of about 8,500 tons deadweight capacity and good speed for their Burmah trade.

Messrs. Napier & Miller, Ltd., Old Kilpatrick, have received an order from The Transports Maritimes to build a steamer of 6,500 tons, similar to one at the same time placed with the Societe des Ateliers et Chantiers de France, Dunkirk.

Messrs. Wm. Hamilton & Co., Port Glasgow, have received a contract for the construction of a large steamer for Dutch owners. The vessel, which will measure about 440 feet, and will have a carrying capacity of about 4,500 tons, is intended for passenger and cargo service. Messrs. Hamilton and Co. have also on order two other large steamers for the Netherland Steamship Co. They have at present five vessels in various stages of construction, one being 500 feet long, the largest ever built at the yard. This and several of the other vessels are being constructed on the Isherwood longitudinal system.

Messrs. The Ailsa Shipbuilding Co., Troon, have contracted to build and engine for Messrs. The General Steam Navigation Co., London, a steamer of 1,200 tons similar to one also just ordered from Messrs. Mackie & Thomson, Govan.

Messrs. The Ardrossan Dry Dock and Shipbuilding Co., Ltd., have succeeded in persuading Messrs. The Ardrossan Harbour Company to increase the length of the graving dock there by some 50 feet, work which will involve a deviation of several railway lines and other alterations. For a long time it has been felt that the Shipbuilding Company lost a good deal of repair work through the graving dock being a few feet too short to accommodate many of the vessels frequenting the port. It is hoped that the addition about to be made will bring more business to the Shipbuilding Company and increase the prosperity of the town.

Messrs. Hall, Russell & Co., shipbuilders, Aberdeen, have secured the contract for the building of a new coastguard cruiser, required for the protection of fisheries. It is understood that for the building of the vessel £14,570 is earmarked for progress up to the end of March.

Messrs. Ramage & Ferguson, Leith, have received an order from Messrs. The General Steam Navigation Co., London, for a steamer of 1,200 tons, similar to those ordered from Messrs. Mackie & Thomson, Govan, and Messrs. The Ailsa Shipbuilding Co., Troon.

Rectifying Form of Ship's Hull.—The paddle-steamer *Eagle III.*, built last year for Clyde passenger traffic, showed a tendency to list by reason of the fine lines on which she was modelled, especially when crowded with passengers. Her owners, Messrs. The Buchanan Steamers, Ltd., have now placed the vessel in the hands of Messrs. A. & J. Inglis, of Pointhouse, who furnished the engines for the vessel, and she is at present on their slip being overhauled. Under the personal supervision of Dr. Inglis, the whole of her underbody has been taken out. It is being replaced on broader lines, and the vessel will be developed in a way which will, it is confidently expected, make her an absolutely safe and steady carrying steamer.

Shipyard Extensions.—The work of extension and rearrangement being carried out at the shipyard and engineering shops of Messrs. The London and Glasgow Shipbuilding and Engineering Co., Govan, of which some particulars have been given in previous issues, have been progressing steadily, and are now in an advanced state. The new building berth for vessels of the largest size—which measures 650 ft. by 95 ft.—is practically complete, so far as ground formation is concerned; and the question of overhead girders and crane equipment is under consideration. The whole of the work connected with the construction of the new tidal basin has been pushed on with great vigour and is now well advanced. The breastwork of sheet piling, about 1,430 ft. in length, extending round the sides and end of basin, is complete; and one half the number of timber dolphins, situated at intervals along each side of basin to afford access to the ships alongside, have been erected. The method of construction adopted—that of sinking wide trenches on the lines of the breastwork and driving the sheet piling therein—has necessitated about 83,000 cubic yards of excavation, about all of which has been thrown up by steam cranes and banked within the space included in the future water-area of the basin. For the past two months or so a powerful bucket dredger, hired from the Clyde Trust, has been dredging out this area. Including the excavated material from the trenches, the amount of earth to be dealt with before the basin is clear amounts to about 300,000 cubic yards.

Greenock Torpedo Factory.—The extensive addition to the Government Torpedo Factory at Battery Park, Greenock, the contract for which, as some time ago noted, was let to Messrs. James Goldie & Co., Glasgow, at the price of £25,000, is now being actively proceeded with. The new buildings which are believed to be intended for the storage of the finished torpedoes and the adjustment of their gyroscopic mechanism, etc., are being erected east of the new main factory and adjoining the test house. Although no additional portion of ground in the neighbourhood has been leased by the Admiralty, the fact that the agreement with the lord of the manor precludes his selling any part of the Battery Park without first consulting the Government, is locally regarded as confirmatory that it is the intention of the Admiralty to construct here docks for torpedo boats and destroyers. On the recent visit to the Clyde of Dr. Macnamara and several Admiralty officials, made ostensibly to inspect the Government work in Clyde shipyards, a considerable portion of their time was spent viewing the new torpedo factory and the ground adjoining; and it is felt in well-informed circles that the outcome may be in the nature of Government docks for the Clyde in the near future.

Clyde Tug's Long Service.—The Clyde Trustees have under contemplation the placing of an order with one of the Clyde firms for a new, more powerful and up-to-date tug steamer to take the place of the paddle-tug steamer *Clyde*, which, for the long period of sixty years, has done service on the river, towing mud-punts, barges and other craft not self-propelled. The very interesting little vessel is not only the oldest paddle steamer now on service on the river, but is probably the oldest tug steamer in active operation anywhere. She is also notable as being still propelled by her original engines, which are of a special kind—a new departure in their day—and seldom subsequently fitted to paddle steamers. These were fitted when the vessel was built in 1851, and were from designs by the late Mr. Andrew Brown, of Messrs. Wm. Simons & Co., Renfrew, who at the time, however, was manager of the engine-works of Messrs. A. & J. Inglis, Whitehall Foundry, Glasgow. They consist of a pair of disconnected and entirely independent engines—one actuating each wheel—an arrangement which allows the wheels to be worked separately, or in opposite directions at the same time, thus facilitating turning in confined areas. The hope has been expressed that when the Trustees are furnished with their new tug they will make arrangements to preserve, in whole or in part, in some fitting repository near the scene of its sixty years' labour, so interesting an example of early time and time tried marine engineering.

Ship Exhibits at Glasgow Exhibition.—One of the most attractive, and certainly not the least educative sections of the forthcoming Exhibition of Scottish History, Art and Science, to be held in the Kelvingrove Park, Glasgow, from May to November this year—the buildings for which are all now very well advanced—is the "Kelvin" Hall, which will house most of the exhibits representing engineering, shipbuilding and allied industries. This hall, which is of impressive architectural proportions, is divided into three sections. The central section, designed to house a memorial

exhibit to Lord Kelvin, is finished in a style to add dignity to such an exhibit, and will, it is hoped, be commodious enough to include a proposed exhibit of Antarctic relics and furnishings associated with the name of Dr. Bruce. The eastern wing of the building will be occupied by exhibits of engineering, printing and electrical interest, the spaces for which have been readily taken by representative firms. The western wing is to be largely devoted to shipbuilding interests. The exhibits already ensured are by well-known firms, including Messrs. The Fairfield Company, Govan; Messrs. Kelvin & White, Glasgow; Messrs. Lobnitz & Co., Renfrew; Messrs. Denny Bros., Dumbarton; and Messrs. Simons & Co., Renfrew. A few spaces are still to let in this section. In one of the buildings on the Exhibition grounds, work is at present proceeding with the preparation of ship models to a goodly scale, representing historical vessels to commemorate the centenary of the first Clyde-built steamship, the *Comet*. Four of these models, well advanced, include Nelson's *Victory* and the latest "Dreadnought." There will be fifteen of these ships in miniature in all.

TYNESIDE AND WEARSIDE.

(From our Own Correspondent.)

Tyneside.

THE feeling among Tyneside shipbuilders has recently been quite optimistic, and the general impression is that the next two or three years are going to be good ones. This feeling is intensified by the Edinburgh Conference result, as the men appear to be satisfied with the advances arranged. It is probable that the unskilled workers will be also moving for a wage advance, as meetings have been held by them, not only in this area, but also at Sunderland and on Teesside. At the graving docks of Messrs. Stephenson at Hebburn there has been a short strike of riveters concerning piece rates on repair work, but the matter was quickly adjusted.

Messrs. Armstrong, Whitworth & Co., Ltd.—The work at the Walker site is being rapidly pressed forward by the contractors for the excavations, Messrs. Nuttall, but the magnitude of the task can only be realized by noting the comparatively small impression made in a given time by the sixteen locomotives, four electric cranes, eight steam navvies, and army of men engaged upon the work. Reports concerning the Elswick works show that a period of high activity is beginning, including mercantile work as well as naval equipment work.

Messrs. Palmers Shipbuilding and Iron Co., Ltd.—The negotiations between this Company and Messrs. Robert Stephenson & Co., Ltd., for the acquisition of the latter concern by the former have now been completed, and the shipyards, graving docks, boiler shop, foundry, etc., have passed under the control of the Palmer Co., who have now the only North-east Coast graving dock of "Dreadnought" capacity. The general manager, Mr. Gowan, and assistant manager, Mr. Williams, will supervise both yards. Three merchant ships will form the commencement of work, which will be done at Hebburn, while the important announcement has been made that the Admiralty has given the firm an order for an armoured battleship cruiser of 28,000 tons displacement and 80,000 horse-power, which will be built at the Jarrow yard. Work is generally brisk, an Ellerman liner having just been launched and is now being finished.

Messrs. Swan, Hunter & Wigham Richardson, Ltd.—Here, again, work is in full swing. The Cunarder *Franconia*, which was launched in July, has been completed and after docking at Hebburn is now back at her old berth ready to leave the Tyne for Liverpool. A sister ship, the *Laconia*, is now being built. It is announced in the local press that as a result of continuous experiments by the firm in the direction of oil-engine propulsion a boat fitted with Diesel engines has been tried with such successful results that Messrs. Swan, Hunter intend to send her on a voyage across the Atlantic in a month or two.

Messrs. Hawthorn, Leslie & Co., Ltd.—This firm has been involved in a controversy with the Walker Coal Co. with regard to a landing stage which the firm uses for the convenience of its workmen. The coal company complain that it interferes with the facilities at its staithes. The matter has come before the River Tyne Commissioners and the Newcastle Corporation, and it is hoped that the affair will shortly be satisfactorily settled.

Northumberland Shipbuilding Co., Ltd.—This firm is very busy. Among recent orders may be mentioned a cargo steamer for Messrs. J. B. Sutherland & Co., Ltd., of Newcastle, for a carrying capacity of 7300 tons.

Messrs. Hepple & Co.—This South Shields firm has received an order from the Buenos Ayres Coast Southern Railway Co., Ltd., for a single screw steel tug and salvage steamer.

Messrs. Brigham & Cowan, of South Shields, have suffered a serious fire involving the pattern shop and storehouse. They have, however, been able to carry on the work of docking and undocking vessels without interference.

Tyne Ferry Service.—The long-talked-of ferry service on the Tyne now appears to be approaching, as the Tyne Ferry Co., Ltd., with £10,000 share capital, has been formed for the purpose of running oil fuel boats each able to carry sixty passengers and calling at seventeen points on the river. The success of the scheme seems assured, as the public are taking up the shares.

Blyth.—The Blyth development scheme has been discussed by representatives of the Blyth Urban District Council and the Blyth Harbour Commissioners, and it is probable that harmonious working will be obtained. The past year has been a very successful one as regards coal shipments, 4,180,171 tons being shipped, an increase of 132,309 tons over the previous year. The Blyth Shipbuilding and Dry Docks Co., Ltd., have secured the order for the repair of the Elder-Dempster liner *Kwarra*, which has proceeded from the Tyne for that purpose.

Wearside.

There is no doubt that the shipbuilding business on Wearside shows tangible signs of improvement, and many yards are showing great activity. There is still, however, a distressing amount of unemployment, and one of the features of the past month has been the operation of the Labour Exchange in facilitating the transfer of a number of riveters to Birkenhead, where they start for Messrs. Cammell, Laird and Co., Ltd., on a twelve months' agreement under trade union rates.

River Wear Commissioners.—It is stated in the press that the River Wear Commissioners are probably about to buy the Sunderland Barracks in order to provide increased warehouse accommodation in connection with the docks. Considerable improvements in making the Wear a deep water port have been effected.

Messrs. Doxford & Sons, Ltd.—The Pallion firm has just received an order for two large steamers from the Clan line of Glasgow and Liverpool, and a statement has appeared in print that this firm is so busy that it can go at full speed for two years with orders already in hand, and that it aims to launch a vessel every three weeks.

Messrs. Osbourne, Graham & Co.—At Hylton, also, work is in full swing, and a rumour of more than usual interest is that this firm is to build a second vessel for the Ericsson Shipping Co., Ltd., of Newcastle, similar to the *Monitoria*. It is certain that this vessel has given satisfaction, and that the issue of shares for the purpose of building a second vessel is in hand.

Messrs. R. Thompson & Sons, Ltd.—This firm is in possession of an order from Messrs. T. Smailes & Son, of Whitby, for a cargo steamer 350 ft. long. Other work is progressing briskly, the trials of the recently launched steamer *Kirkwood* having been most satisfactory.

Messrs. McColl & Pollock.—This engine works, together with the other marine engine builders on the Wear, is very fully occupied at present. A subsidence which occurred on the quay at first created feelings of alarm for the safety of a large crane recently erected by the firm, but subsequent examination showed that the damage was not serious.

THE TEES AND HARTLEPOOLS.

(From our Own Correspondent.)

Middlesbrough.

ALL the yards here are now in full swing, and in some cases the shipyards are handicapped for want of gangs of riveters.

Messrs. Sir Raylton Dixon & Co., Ltd., Cleveland Dockyard, are reported to have secured an order for a steamer for Liverpool owners for early delivery; enquiries now are in nearly every case for early delivery, and builders are in consequence asking 5 per cent. more than recent current prices.

Messrs. W. Harkess & Co. are likely to secure the order for two small steamers in the market, and are now busy with work on hand.

Messrs. Richardsons, Westgarth & Co., Ltd., are in full swing again and have secured another order for the engines and boilers for a steamer building on the Tees. They have sufficient work to keep them busy throughout the current year. Nearly all their marine engines are now fitted with the Contraflo type of condenser, which is giving such excellent results.

Messrs. Smith's Dry Dock Co., Ltd., are very busy, having several small steamers and trawlers on hand. The engine-works, dry dock and repair departments are in full swing.

Stockton and Thornaby.

Messrs. Richardson, Duck & Co., are reported to have secured an order to build a cargo steamer for early delivery.

Messrs. Craig, Taylor & Co. are very busy; they are reported to have secured an order for a cargo steamer of about 4,200 tons deadweight for a West Hartlepool firm, the engines and boilers to be supplied by Messrs. Maccoll & Pollock, Sunderland.

Messrs. R. Ropner & Sons are getting busy again and are reported to have secured an order to build a cargo steamer for foreign owners, the machinery to be supplied by a firm on the Tees.

Messrs. Blair & Co. are very busy, being in a position to give early deliveries, as they worked right through the strike of the boilermakers. They are reported to have secured two or three orders already and may be said to have sufficient work to last through the year.

West Hartlepool.

Messrs. W. Gray & Co. have recently booked an order for a large steamer for Messrs. Strick & Co., London, to be built under the superintendence of A. Walker, Esq., also a medium-sized cargo steamer for Messrs. J. F. Wilson, Son & Co., of West Hartlepool, under the superintendence of H. Withy, Esq. This firm is now nearly in the position of having to refuse orders, as they are so busy.

Messrs. J. Baird & Co., timber merchants, are reported to have placed an order for a cargo steamer to be built on the Tees and engined on the Wear.

Messrs. Irvine's Shipbuilding and Dry Dock Co., Ltd., Harbour Dockyard, are very busy. They have recently booked an order for two small steamers for foreign account. The repair and dry dock departments are also full up.

Messrs. The Central Marine Engine Works are very busy and have booked the order for the engines and boilers for all the new tonnage to be built at Messrs. W. Gray & Co.'s shipyards.

Hartlepool.

Messrs. Richardsons, Westgarth & Co., Ltd., are now very busy. Changes have recently been made in the Directorate. Admiral Douglas, of Messrs. Hadfield's, Sheffield, and John Esplen, Esq., consulting engineer, Liverpool, replace Thos. Richardson, Esq., and Hon. Marmaduke Furness on the Board. The Company has booked the order to supply the engines and boilers for a large cargo steamer, a sister-vessel to one ordered by Messrs. Milburn & Lund, Whitby. They are now fully employed in their speciality department.

Messrs. Irvine's Shipbuilding and Dry Dock Co., Ltd., Middleton Yard, have booked an order for a large cargo steamer of about 6,600 tons deadweight for Messrs. Temperley & Co., London, for early delivery. They are now very busy and are believed to be booked up to the end of the year.

THE HUMBER AND DISTRICT.

(From our Own Correspondent.)

Messrs. Earles' Shipbuilding and Engineering Co., Ltd.—This yard is now in full swing, and has received an order for a fifth steamer to be called the *Stockport* from the Great Central Railway and Steamship Co., to run between the Continent and Grimsby. The vessel is to be well fitted up for passenger traffic and have a good sea speed. An order for a new steamer for the St. Petersburg trade of the Wilson line of Hull has been secured. This steamer is to be similar to the Company's s.s. *Tosno*, and will be used for passenger and cargo service. The vessel will be fitted with refrigerator for carrying butter and poultry. The Wilson line and North-Eastern Railway Co. have also placed an order for a new steamer of good sea speed, to carry passengers and cargo, for the Hamburg trade. The carriage of fruit in the season will be a feature in this particular steamer, as she can come alongside of the Riverside Quay at any state of the tide, and fruit can be despatched to the northern and midland towns without delay, as the Company's rails are alongside Riverside Quay. The Wilson liner *Jaffa* has undergone extensive repairs on the yard slips, having been ashore in the Baltic. The s.s. *Liberty*, owned by the Lancashire & Yorkshire Railway Co., has undergone extensive repairs, having been ashore. The s.s. *Jesseric*, of Glasgow, is about going under expensive repairs, having met with severe weather in the Pacific Ocean and incurred damage to deck houses, etc.

Messrs. Amos & Smith, Ltd., are fully employed with new work, and have booked several orders for machinery for trawlers. The vessels are for Grimsby and Hull owners, and are to be delivered in the second half of the current year. Their branch shop at Alexandra Dock is fairly engaged with steamers in the dry dock, notably a Hull-owned steamer going under extensive repairs in the hull, etc. A large Liverpool steamer is also undergoing repairs.

The North-East Coast Engineering Works have been very busy during the last month. The s.s. *Highlander* has undergone extensive repairs to deck, engines and boilers. A new crank shaft and tail end shaft has been supplied and fitted. The s.s. *Hampshire* and s.s. *Carlton* have had engine and deck repairs effected. The s.s. *Hawthorn* is in graving dock having new stern post fitted and several new plates, and undergoing Lloyd's survey. Several large steamers are coming to Hull to be prepared for Lloyd's survey by this firm.

Hull Central Dry Dock and Engineering Works have been fairly busy, with ships in the Company's graving dock, and have had to requisition the Hull and Barnsley Railway Co.'s graving dock. The following repairs have been effected—s.s. *Broomhill*, repaired stern frames, bottom damages and deck repairs; s.s. *Segovia*, new rudder fitted, engine-room and deck repairs; s.s. *Narcissus*, new rudder, stern tube and gland and propeller shaft, also engine and deck repairs.

Messrs. C. D. Holmes & Co., Ltd., Hull Engineering Works, have had a good month, and booked five orders for machinery for trawlers for Grimsby and Hull owners, and have been busy building their large compound winches for trawling; these particular winches are about 15 ft. across and very powerful. Their branch shop, situated at Alexandra Dock, has been busy with repair work on steamers and graving dock. They have also a number of inquiries for new and repair work.

Messrs. Woodall & Co., engineers and boilermakers.—This shop has been well employed in new work, forgings and with repair work at the Corporation Tram Works on boilers and engines. The patent purchase blocks have been in great demand for different countries, and orders are still arriving.

Messrs. Cooper & Co., Ltd., Neptune Engine Works, have had a splendid month with repair and graving dock work, the engine and boiler shops have been kept at high pressure, so many ships being under repair. The moulding shop and patternmakers have been also very busy, with engine castings, cylinders and propellers for home and foreign markets. The Company's graving docks, situated in old harbour, have been well booked up with coasting and river craft steamers, and the branch works at Alexandra Dock have also been fully employed with steamers in graving docks and general repair work.

Fish Dock.—The fitting shops situated on St. Andrew's Docks, belonging to the different trawling companies, have been well employed with repairs, etc., and the patent slips belonging to the North-Eastern Railway Co. have been well engaged with steam trawlers, cleaning hulls, painting and propeller work. Several trawler companies have contracts signed for new trawlers, to be built to Lloyd's requirements.

Messrs. Cochrane & Sons, shipbuilders, Selby, have been successful in securing orders for local and Grimsby owners and we understand are well booked up for certain deliveries.

Messrs. Cook, Welton & Gemmell, shipbuilders, Beverley.—This firm launched a trawler on the 17th January for Messrs. Pickering & Haldane, Hull, to be fitted to Lloyd's requirements, and they have been very successful in securing a large number of orders for trawlers for the Humber district.

It is understood the Wilson Line have given out an order for a large steamer for their Indian trade, and it is hoped that local shipbuilders will benefit by same.

SOUTH OF ENGLAND AND ISLE OF WIGHT.

(From our Own Correspondent.)

Messrs. J. Samuel White & Co., Ltd., East Cowes, I. of W.—H.M.S. *Rifleman* torpedo-boat destroyer and the second ship of this class under construction at the yard of the above firm, had a satisfactory preliminary trial about the middle of last month, and will have completed her official trials by the time these notes are in print. H.M.S. *Ruby*, the third vessel to the same order, was also undergoing preliminary trials last month. Rapid progress is being made with H.M. ships *Ferret* and *Forester*, of last year's programme. A serious fire occurred at the front workshop and offices of Messrs. William White & Sons, yacht builders, last month——the buildings being practically destroyed. The books and valuable drawings were saved, but many models of boats and yachts were destroyed. This fire has been misunderstood in many quarters as affecting the works of Messrs. J. Samuel White & Co., but this is not the case.

Messrs. Day, Summers & Co., Ltd., Northam Iron Works, Southampton.—The steam yacht *Dotterel* arrived at the yard last month to have a new boiler fitted, and other work carried out, also the P.S. *Queen* was undergoing repairs. The three instructional turrets for Devonport, Chatham and Eastney are now nearing completion, and will be shipped during the month. The s.y. *Honor* was laid up at the yard during January, having damage caused by stress of weather made good, also the s.y.'s *Catania* and *Medusa* are fitting out for the Mediterranean. Good progress is being made with the paddle steamer, the keel of which was laid in December, and last month the vessel was in frame.

The new wet dock at Southampton is now occupied by three ocean liners, which have taken up berths there to ease the pressure at the regular berths. The work in connection with the erection of the sheds is also in hand, but the dock will not be ready for incoming vessels until about May, and it will be some considerable time after the opening of the dock before the work in connection with the sheds, etc., is completed. The area of the dock is about 16½ acres. Work on the lengthening and widening of the Trafalgar Dry Dock is making good progress, and it is anticipated that it will be ready for use early next year.

The R.M.S.P. Co. have secured the contract for the carriage of the West Indian mails and the steamer *Clyde* commenced the fortnightly mail and passenger service on the 18th of last month. The headquarters of the service in the West Indies is to be Trinidad, which contributed £20,000 of the total subsidy of £63,000 per annum.

The first vessel to arrive at Southampton in connection with the new fortnightly refrigerated cargo service, which Messrs. Houlder Bros. have decided to establish between the Argentine and Southampton, will be the *Thorpe Grange*, which is due to arrive about the end of this month. The meat companies concerned in the service are the Frigorifico Argento and the Compania Sansinena de Carnes Congeldas, the latter company being the oldest meat company in Argentina. Both companies have offices in the dock near the Cold Stores, and it is understood that Messrs. Houlder Bros. will open offices of their own at Southampton.

Messrs. J. I. Thornycroft & Co., Ltd., Southampton.—H.M. ships *Larne*, *Lyra*, *Martin* and *Minstrel*.—The two first-named vessels were opened up last month for final examination of machinery. H.M.S. *Martin* will be ready for her trials early this month, and work on the *Minstrel* is making good progress. H.M. ships *Acheron* and *Ariel*.—The bulkheads, beams and engine and boiler seatings were completed last month. The motor barge *Rocklight of London* has successfully completed her official trials. Barge for Portsmouth Dockyard.—The shell plating was completed last month. The 60-ft. T.S. launch for the Amazon successfully completed her trials last month, and the boat has been shipped to South America. New Orders.—The keels of the stern wheel passenger steamer for the Persian Gulf, and for the first of the ten armoured motor patrol boats for the Turkish Government were laid in January. Repairs.—The repairs department has been well occupied during the past month, the ships in hand being H.M.S. *Julia*, s.y.'s *Erin*, *Rovenska*, s.s. *Rewa*, *Raven*, *Sandfly* dredger, *Mercurius* and sailing ship *Stroemsbo*, the bows of which were badly damaged by collision in the Channel.

Messrs. Simpson, Strickland & Co., Dartmouth.—Work in all departments is fairly brisk, a large amount being for the Admiralty. Some 35-ft. steam cutters and a 50-ft. steam pinnace ran their trials last month. A 30-ft. steam cutter for H.M.Y. *Alexandria* is being constructed, and a start has been made on a second 50-ft. steam pinnace. Among other boats on order are a 32-ft. steel launch for a colonial order, five boats for a yacht building at Leith, a 22-ft. yacht's launch, also a 25-ft. yacht's launch. A very fine 30-ft launch is being built for a steamer in the North, and a 35-ft. boat for a local gentleman is in hand. Orders have just been booked for two very high-class yacht's launches, 28 ft. and 27 ft. long. In addition to the machinery for the hull of the above boats some sets of machinery for home and foreign orders are in hand, as well as several boilers. Alterations are also being carried out to the auxiliary ketch yacht *Brown Mouse*, and the well-known yawl *Florinda* is being converted to ketch rig. A 50-ft. steam launch has just been despatched to Aden, and last month a large water tube boiler for a foreign order was also completed and despatched.

THAMES.

(From our Own Correspondent.)

Port of London.—From returns just issued we are enabled to judge somewhat of the first year's working by the Port of London Authority, and though it is too early perhaps to make any deductions it is evident that as yet there are no advantages to be claimed by the new *regime*. The figures show that while London's increase in vessels is only eighty-eight in 1910 over 1909, Hamburg gives 343, Antwerp 300 and Rotterdam 791. In tonnage the increases are:—London, 630,809; Hamburg, 472,732; Antwerp, 608,912; Rotterdam, 1,082,280. This is not encouraging reading, but it will be seen London's tonnage is high, though well behind the increase of Rotterdam. What is fairly clear, apart from other considerations, is that charges must be kept down. Anything that tends to expense prevents trade and the new Authority has therefore an uphill fight before it if we are to retain supremacy.

Shipping Companies.—The P. & O. Co. have had launched for them at Messrs. Harland & Wolff's yard the *Maloja*, the largest vessel they will possess. She is 569 ft. long, with a gross tonnage of 13,000, the accommodation being for 450 first-class and 220 second-class passengers. The new East African service by the Union Castle Line seems to be working well and to have a promising future before it. By its agreement with the Government for ten years, the Company carries all Government passengers and emigrants and cargo for the Protectorate, and also the mails both ways, and is assured therefore of all the support that this conveys with it. The difficulty with the Royal Mail Co. has been ended by the Government coming to a seven years' agreement with the Company for the carriage of the mails to the West Indies for an annual subsidy of £63,000. A deadlock had almost been reached before the Government

gave in, the last steamer being announced by the Company, after which they would guarantee nothing. It appears that a subsidy was paid up to 1905, since which the Company say they have not been fairly treated. Under the new arrangement Trinidad will be the first port of call, this island having contributed £20,000 towards the subsidy, and from this point the inter-colonial service will begin, instead of as hitherto from Barbados. It is a satisfactory termination to what has been unpleasant reading for some months past. This Company has appointed Mr. R. L. Forbes as manager, in place of Mr. A. S. Williams, resigned.

The Institution of Naval Architects.—This Institution, which was founded in 1860, has received an intimation from the Lord President of the Privy Council to the effect that the King has been pleased to approve of the grant of a Royal Charter of incorporation to it.

The "Waratah" Inquiry.—In this lengthened and important matter the engineer assessor was not able to continue to sit, owing to severe indisposition, and the enquiry was continued without him, there being no question about the character of the engines at issue. The evidence was explicit that the storm the vessel was supposed to have foundered in was a severe one, but as regards the ship's behaviour at sea many adverse opinions were expressed by men who had been to sea in her, including that of a professor of science. Sir W. White was called on behalf of the owners, and said he did not attribute any want of stability to her, and that the coal bunker on the spar deck with a capacity of 600 tons he did not consider a source of danger at all. The curves got out at the including experiments by the builders he thought were satisfactory in every way, and other evidence on behalf of the owners argued for the vessel's safety, provided she was stowed as described on facts obtained from Durban, her last port of call.

MERSEY AND MANCHESTER SHIP CANAL.

(From our Own Correspondent.)

MATTERS have now settled down to their normal state, with the resumption of work after the strike and holidays. The arrears of work on hand, indeed, has a tendency at present to exceed the supply of labour. These points, however, are rapidly adjusting themselves, and it is confidently expected that this year will be a record one, especially as regards Admiralty work.

Messrs. Cammell, Laird & Co.—All sections of these extensive works at Tranmere and Birkenhead are now busily employed upon the large number of contracts in hand, and the immense resources of this great undertaking are now absorbing a large amount of labour. It was recently reported that representatives of the firm were enquiring for shipyard workers in the Sunderland district, 600 men being required with a guarantee of twelve months' work. Mr. R. R. Bevis, who has for many years carried out the duties of general manager with distinction, has been appointed managing director. Mr. Bevis, some years ago, brought out a patent feathering propeller, which was fitted to a large number of vessels, and later was associated with Mr. J. H. Gibson, the present engine-works manager, in perfecting the "Bevis-Gibson" torsion meter, now largely used for calibrating the torque of shafting in turbine-driven steamers. Mr. E. H. Mitchell has been appointed to the position of general manager, and took up the duties at the new year. Mr. Mitchell, it is understood, was trained at Fairfield and the Royal Naval College, Greenwich, and recently acted as secretary to Sir Philip Watts, and also to the "Dreadnought" committee on designs. Recently Mr. Mitchell was at Elswick and Greenock supervising the building of "Dreadnoughts," and has seen some twelve years' Admiralty service. The immense floating dock is now making rapid progress, while the improved "Town" class cruiser *Melbourne* is well under way. The battleship *Audacious*, of the *Monarch* type, has also been commenced, strict secrecy being maintained in all branches of construction. The destroyers *Lapwing* and *Lizard*, together with the four Argentine boats, are well advanced. The first vessel for the Argentine Navy will be launched early in February, the other three will take the water shortly after. The work on the two tenders for the submarine depot ship is being rapidly advanced; these vessels, it is understood, will be known as the *Adamant* and *Alecto*, and will be a novel and interesting type of vessel. The repair department has now resumed its wonted activity and has in hand several large contracts.

Messrs. H. & C. Grayson.—An amalgamation has recently taken place between the above firm and Messrs. Clover, Clayton & Co., Mr. H. M. Grayson having joined the board of the latter firm, this following upon the retirement of Mr. Matthew Clover after an active association of forty-seven years with the Birkenhead yard. It is understood that Mr. Guy S. Clover will continue to act as Secretary to Messrs. Clover, Clayton & Co. as heretofore. Messrs. Grayson have recently completed the tenders for the C.P.Rly.Co., and now have on hand a similar vessel for the P.S.N.Co. The dredger *Walter Glynn* has had extensive damage repairs completed, due to capsizing off Seaforth. The tender, *James J. Bibby*, to the training-ship *Indefatigable* has had repairs and overhaul. At the Garston works, the oil tank steamer *Potomac* has been in for extensive repairs and overhaul, also the *Pioneer* has had general repairs. There are many other contracts in hand.

Messrs. David Rollo & Sons.—This firm continues to be very busy with ship and engine repair work, and amongst many contracts in hand may be mentioned the White Star liner *Baltic*, which recently sustained considerable damage in collision. The P.S.N.Co.'s steamers *Esmaraldas* and *Oriana* have been in for extensive repairs, as also the steamers *Zero*, *Star of Victoria* and *Star of England*. The sailing ship *Senator* is being converted into a coal hulk, and the Cork S.S. Co.'s *Harelda* is in dry dock for annual survey and overhaul. This firm employ the oxy-acetylene process extensively and find it very successful with repair work of all kinds. Two large boilers, each weighing over 60 tons, are being made for the North Wales S.S. Co.'s steamer *Saint Tudno*, also two double-ended boilers for the City of Dublin Steam Packet Co.'s steamer *Louth*. New boilers are also being fitted to the Booth Liner, also the steamers *Trafford* and *Bathurst*. In connection with the *Saint Tudno*, the hull will be given a complete overhaul and all deteriorated parts removed and new parts substituted.

Liverpool Salvage Association.—A salvage station is contemplated by this Association at Holyhead, negotiations being now in progress for a site. Large pump and gear sheds are to be provided, also berthage for a salvage steamer, probably the *Linnet* or *Ranger*. Important developments are also expected at Liverpool for further increasing the Association salvage service upon the river and district.

The Manchester Ship Canal.—The Ship Canal Companies Bill for the next session of Parliament provides for the construction of a pier or jetty in the Mersey estuary at Hooton on the seaward side of the easternmost lock of the canal of Eastham, the construction of a railway provision for the collection of Customs and other dues, also to enable the Company to grant leases for 999 years instead of 99 as at present. Early in April the service of steamers from the canal to Pernan will be inaugurated, while the Cunard Co.'s steamer *Tyria* will shortly load at Manchester for the Levant, this being the first Cunard boat to load at Manchester.

Mersey Docks and Harbour Board.—The Taylor's Bank Revetment Scheme has recently been completed. A bank of stone being constructed for a length of 13,200 feet and the erosion of Taylor's Bank and the advance of Askew Spit have entirely stopped. A stone-faced bank will shortly be constructed from the south end of the Herculaneum River Wall in the direction of Dingle Point for a length of 2,167 yards. Last July the Dock Board decided upon the construction of a new dock at the north end to accommodate vessels up to 1000 ft. in length. The dock will be 1020 ft. long, with an entrance depth of 35 ft. and 45 ft. on a 10-ft. and 20-ft. tide respectively. The work was begun in September, and will be completed in three years at a cost of £500,000. Some 400 men are now employed and about 100,000 tons have up to the present been excavated and tipped. A quay of concrete 50 ft. wide will form the sides of the dock, upon which will be built sheds. When finished, the dock will be the finest in the world, enabling the largest liners to dock an hour before and after high tides.

White Star Line.—With the advent of the *Olympic*, which is expected to dock in Belfast about March 30th, various changes will take place in the Company's service to New York. The *Adriatic* will make her last run to New York from Southampton on July 26th, after which she will sail from Liverpool; the *Teutonic* also will be placed on the Liverpool Canadian route. A weekly service will be maintained by the steamers *Olympic*, *Oceanic* and *Majestic*, sailing from Southampton on Wednesdays and from New York on Saturdays.

NORTH-WEST OF ENGLAND.

(From our Own Correspondent.)

Barrow-in-Furness.—There is activity in every department of the shipbuilding trade at Barrow, and the orders in hand are of considerable importance. Some folks expected the Vickers firm would have been successful in pulling off the order for the battleship-cruiser for the Admiralty which has been placed with Tyne builders, but it was not policy on the part of Barrow builders to crowd their yard with over much work at present, inasmuch as already two immense armoured cruisers are in hand, one for Britain and the other for Japan, together with an immense amount of other work; and there is the prospect of even more work coming to hand from other sources. So that the loss of the Admiralty battleship cruiser can be tolerated, not only in view of the great amount of work already in hand, but also of the prospects of other orders of considerable importance coming their way in the near future.

Unwonted Activity.—The effect of the boilermakers' lock-out is to be seen in the high pressure which now exists in the shipbuilding yard at Barrow. The fullest energy is being shown in the work of progress in the construction of the British battleship *Princess Royal*, which is to be launched in the course of a month or two; and there is also much progress shown in the building of the Chinese cruiser, which is understood to be the forerunner of other orders from the same quarter. The *Dartmouth*, one of the "Town" cruiser scouts, will be launched in February, and the Aberdeen floating dock is also nearing completion. The Vickers firm have only one torpedo-cruiser in hand for the British Admiralty, but they are acquiring fine data in this branch of construction, which will be useful to them in future tendering for this class of work. There is much activity in the submarine department, and although nothing is officially allowed to be known as to the orders in hand, it is known that much work is in progress in the submarine shed, and that this is all for the British Government is more than surmised. There are still several vacant slipways in the Barrow yard, and it is possible to lay at least four or five of the largest warships or ocean liners down in addition to the two big vessels and other smaller ones now on the stocks. Some day it is expected that the whole of the shipbuilding yard, the largest in this country and probably in the world, will be full of ships in course of construction.

The British Airship.—The statement has gone forth that the new naval airship building at Barrow by the Vickers Company was now practically ready for flight. This, we learn, is not the fact. Very great care has been taken in the building of this vessel, and many alterations have been made in her since the original design. Further than this, advantage has been taken of up-to-date experience with the view that when the dirigible takes to flight she will be as perfect as it is possible to make her. It is therefore somewhat uncertain when the experimental trial will take place, but it is safe to surmise that it will be the spring months before the airship merges into the open. It is believed in Barrow that other airships will be built to succeed No. 1, which is now completing, and that this will probably become an important industry in the town.

Engineering.—There is probably no engineering shop in the world so busy as that of Messrs. Vickers, Sons & Maxim at Barrow, and certainly there is no engineering establishment so large, or so fully equipped in all departments, and there are very many of these. There is a continual inrush of all the best and most up-to-date mechanical appliances, to deal either with new work, or to replace other tools by modern machines which are better and more economical than those hitherto in use. Probably the present year will witness the production of a greater indicated horse-power of engines than has hitherto been possible in any establishment in the world. In addition to marine engineering, the firm is very busy with gun mountings in connection with 12 in. and 13·5 guns for vessels building at Barrow and by other firms in various parts of the country, and also for warships building in Government dockyards.

New Offices.—The Vickers firm are on the point of completing, or more correctly speaking, half completing, new offices at their works at Barrow. The half of a proposed gigantic building which is now practically ready for occupancy is intended to house the clerical department, the ship's draughtsmen, the manager's offices in connection with the shipbuilding department, and the Board Room and General Offices. The scheme will ultimately entail the addition of the engineering staff, which will have to be housed later on. The firm are busy with the rebuilding of the joiners' shop, which was burnt down some time ago.

Hæmatites.—The demand for hæmatite iron has improved and the output has been increased. Prices are higher, at 68/6 for Mixed Bessemer Nos. nett f.o.b. and 67/2 warrant sellers cash.

Shipping.—New life has been imparted to the shipping trade alike in imports and exports since the opening of the new year.

BELFAST.

(From our Own Correspondent.)

Work in Hand.—According to Lloyd's returns Belfast heads the list for new tonnage under construction at the end of the last quarter of 1910. At that time there were twenty-four steamers building on the Lagan, with an aggregate tonnage of 250,807. On 30th September, 1910, the number was nineteen, with a total gross tonnage of 232,000, and on 31st December, 1909, there were fifteen with 168,210 tonnage.

Messrs. Harland & Wolff.—On 14th January, the handsome new twin-screw liner *Themistocles*, built at the Queen's Island for Messrs. Geo. Thompson & Co.'s well-known Aberdeen line, left Belfast after a successful trial trip. The *Themistocles* is 517 ft. long, 62 ft. 3 in. beam, and has a gross tonnage of 11,232. She has extensive cargo capacity and passenger accommodation, and is intended for the company's service between Britain and Australia. The propelling machinery consists of two sets of quadruple-expansion engines, balanced to prevent any vibration. A sister ship, named *Demosthenes*, will be launched in a few weeks' time. She is similar to the *Themistocles* in every respect, except that of propulsion. The *Demosthenes* will have three screws, the centre propeller being driven by a low-pressure turbine, and the wing propellers by reciprocating engines.

Messrs. Workman, Clark & Co.—This firm has commenced the year by the launching of two vessels during January. On the 5th of the month they put into the water from their south yard the fruit-carrying steamer *Aracataca*, which they have built to the order of Messrs. Elders & Fyffes, Ltd., London. She is 390 ft. long, with a gross tonnage of about 4,100. The propelling machinery consists of a set of triple-expansion engines, steam being supplied by four single-ended boilers. On the 12th they launched the twin-screw steamer *Anchises* for Messrs. Alfred Holt & Co., Liverpool. The new vessel is the last of three similar vessels ordered from Messrs. Workman, Clark & Co., for the Blue Funnel line, all of which have been built for the Company's recently established passenger service between Great Britain and Australia.

Harbour Notes.—The contractors are working night and day to have the new graving dock ready to take the White Star liner *Olympic* on the 31st of March. Everything possible will be done to accomplish this, and at the present time the coffer-dam is being removed. For some time past the Harbour Commissioners have had under serious consideration the question of the congestion of the port. The first thing to be done will be to get over the overlapping of the cross-Channel steamers at the Donegal Quay. This trouble will be overcome by transferring several of these steamers to the Queen's Quay, which has always been occupied by the coal trade. The question therefore that is exercising the minds of the Commissioners is, where to put the colliers. There are several alternatives before them, but what scheme will be adopted it is impossible at present to tell.

Londonderry.—In a recent issue of the *Marine Engineer* reference was made in these notes to the prospect of the Derry shipyard being reopened. Negotiations have from time to time been carried on between the port and Harbour Commissioners—who are the landlords of the yard with all its plant—and prospective tenants, but these negotiations have proved abortive. Now, it appears, there is every prospect of shipbuilding being revived on the Foyle. At the annual meeting, held recently, the chairman (Sir John Johnston) stated that there was now every likelihood of the yard being reopened at an early date.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Armanistan.—On January 2nd, Messrs. William Gray & Co., Ltd., launched the large steel screw steamer *Armanistan*, which they have built for Messrs. Frank C. Strick & Co., Ltd., of Swansea and London. Her principal dimensions are :—Length overall, 372 ft. ; breadth, 47 ft. ; and depth, 25 ft. 3 in. She is a handsomely modelled vessel of the two-deck type, with poop, bridge and forecastle and a sun deck over the bridge. Very tasteful cabin accommodation is provided in houses on the bridge deck for passengers, captain and officers. An electric lighting installation is being fitted, including a Suez Canal projector light. The vessel will take Lloyd's highest class and has a cellular double bottom and after-peak tank for water ballast. The decks are of steel and teak. The steam windlass, steam-steering gear, steam winches, large marine type donkey boiler, and the whole of the outfit are of the most approved description, including Porter's patent derrick sockets for dealing with heavy lifts by combining the ship's ordinary derricks. The machinery is made by the Central Marine Engine Works of the builders, being of the triple-expansion type, with cylinders 25 in., 40 in. and 65 in. diameter and a 42-in. piston stroke. She is also fitted with Weir's feed pump and heater and two large steel multitubular boilers working by Howden's system of forced draught at a pressure of 180 lbs. per square inch.

Argentine Transport.—On January 14th, Messrs. Irvine's Shipbuilding and Dry Docks Co., Ltd., launched from their Middleton Shipyard, West Hartlepool, the steel screw steamer *Argentine Transport*, built to the order of Messrs. Furness, Withy & Co., Ltd., West Hartlepool, for Messrs. The Empire Transport Co., Ltd. (Messrs. Houlder Brothers & Co., Ltd., managers), London. The dimensions of the vessel are 400 ft. in length by 52 ft. beam extreme, by 29 ft. 6 in. depth moulded, carrying over 8,200 tons on a moderate draught. She is built to British Corporation Classification, having a single deck of steel with clear holds, with poop, bridge and forecastle and water ballast is carried in cellular double bottom and in fore and after peak tanks. The vessel is constructed with deep frames and longitudinal stringers, and is divided into seven watertight compartments by means of six watertight bulkheads. Wood grain divisions are fitted throughout the holds according to the latest Board of Trade Regulations. Four large hatches are provided and cross bunker hatch, and all the latest facilities are included for the rapid loading and discharging of cargo, with eleven steam winches exhausting back into stokehole, and twelve derricks. A powerful quick-warping steam windlass is fitted forward, with steam-steering gear amidships and hand gear aft. The captain, officers and engineers will be berthed in large houses amidships, and the crew and firemen in the forecastle. The lighting, heating and sanitary arrangements have received special attention, the most improved methods being adopted throughout. Triple-expansion engines are being supplied by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, with cylinders 25 in., 40 in., 68 in. by 48 in. stroke, with three large boilers working at a pressure of 180 lbs. per sq. inch.

Vendee.—On 14th January, Messrs. Sir Raylton Dixon and Co., Ltd., launched from their Cleveland Dockyard, Middlesbrough, a fine steel screw passenger and cargo steamer, which is being constructed to the order of Messrs. James Moss & Co., of Liverpool. Her principal dimensions are :—256 ft. 3 in. by 38 ft. by 18 ft. moulded, and she will have a deadweight carrying capacity of nearly 2,000 tons on a light draught of water. She is being built to the highest class at British Corporation, and is of the single-deck type with shelter deck and bridge and forecastle. Captain's accommodation, chart-room and entrance-house to saloon will be provided in a neat steel house on bridge deck and on the deck below will be the saloon and first-class state-rooms at fore end, and officers' and engineers' berths at after end. The petty officers will be located in forecastle while the firemen and crew will be quartered in poop. The vessel has two holds, four hatches, two masts, nine derricks, and will be equipped with five steam winches, steam windlass, hand and steam-steering gear, electric light and all the most modern appliances for the rapid handling of cargo. Triple-expansion engines, having cylinders 21½ in., 36 in. and 59 in. by 39 in. stroke, supplied with steam by two large single-ended boilers working at 180 lbs. pressure, will be fitted by Messrs. John Dickinson & Sons, Sunderland.

City of Durham.—On January 15th, there was launched from the Jarrow yard of Messrs. Palmer's Shipbuilding and Iron Company (Limited), the steel screw steamer which has been built to the order of the Ellerman Lines (Limited), of London and Liverpool. The vessel is over 400 feet long, and has been built to the highest class in Lloyd's Register. She has complete 'tween decks, with long bridge, poop and forecastle, and is fitted with longitudinal girders under the beams and wide-spaced hold pillars, giving clear holds for cargo. Water ballast is provided for in cellular double bottom, also in deep tank and aft peak. Accommodation is provided for captain and officers, and there are spare berths in steel houses on bridge deck amidships, the crew being berthed in topgallant forecastle. The vessel is fitted with electric light throughout, and is equipped with a very complete system of derricks and steam winches for rapid working of cargo. She has been designed to carry about 8,400 tons deadweight. The vessel will have triple-expansion engines, also manufactured by the builders, which will give her a speed of between 11 and 12 knots.

Vallington.—On January 18th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby a handsomely modelled steel screw trawler, the principal dimensions being 130 ft. by 22 ft. 6 in. by 12 ft. 9 in. moulded. The vessel has been built to the order of Messrs. The Premier Steam Fishing Co., Ltd., at Grimsby, and will be fitted with powerful triple-expansion engines by Messrs. C. D. Holmes and Co., Ltd., of Hull, and is replete with all the latest improvements for fishing purposes.

Highland Loch.—On January 17th, Messrs. Cammell, Laird & Co., Ltd., launched the third of the Nelson Liners, which has been named *Highland Loch*. This vessel is to be used on the River Plate trade, and is 414 ft. between perpendiculars, 56 ft. beam with a depth to shelter deck of 37 ft. 8 in. The vessel has accommodation for first and second-class passengers, and will have storage for 3,500 tons of chilled meat. Messrs. Wailes, Dove & Co.'s " Bitumastic " enamel was applied to the bunkers and engine and boiler-room tanks, and their " Bitumastic " covering to tank top in boiler space, also in refrigerating spaces.

LAUNCHES—Scotch.

Strathlethen and Strathfinella.—On December 19th, these steel ketch-rigged steamers of about 198 tons gross each, named as above, were launched at Aberdeen for Messrs. The Aberdeen Steam Trawling and Fishing Company (Limited). The port of registry is Aberdeen.

Culblean.—On December 29th, a steel ketch-rigged steamer of about 200 tons gross, named *Culblean*, was launched at Aberdeen for the owners, Messrs. The Grampian Fishing Company (Limited). The port of registry is Aberdeen.

El Zarate.—On December 31st, at Grangemouth, there was launched the twin-screw light draught steamer *El Zarate*, which has been built to the order of Messrs. The Smithfield and Argentine Meat Company, London and Buenos Ayres. The vessel has been specially built for the carriage of a large quantity of chilled meat from the depot of the Company up river to the ocean-going steamers which convey it to this country. The dimensions are :—Length, 210 ft. ; breadth, 42 ft. ; and depth moulded, 11 ft. 3 in. She will carry her complement of chilled meat in four refrigerated and insulated compartments on the very light draught of 6 feet. She is classed to British Corporation for carrying refrigerated cargoes. The meat holds have an aggregate capacity of 50,000 cubic feet. Twin-screw engines of large

power, with two boilers, will be fitted. Messrs. Wailes, Dove and Co.'s "Bitumastic" cement was applied to flat of bottom and their "Bitumastic" enamel to ship's sides and frames in bunker spaces.

Margaret Wetherly.—On January 4th, a steel screw trawler, built to the order of Messrs. The Wetherly Steam Fishing Company (Limited), Aberdeen, was launched at Aberdeen. The vessel, which will be fitted with triple-expansion engines, was named *Margaret Wetherly*.

Ellenga.—On January 17th, Messrs. Alex. Stephen & Sons, Ltd., Linthouse, launched the steamer *Ellenga*, one of the twin-screw vessels now under construction by them for the Indian Coastal Service of the British India Steam Navigation Co., Ltd. The *Ellenga* is 425 ft. in length, 52 ft. in breadth and 35 ft. in depth. She has three complete decks, with bridge and boat decks above, and has accommodation for fifty first-class and fifty second-class passengers, both classes being equally well fitted up. Special provision has also been made for native passengers, two complete decks being reserved for their use. The propelling machinery consists of two sets of triple-expansion engines, with two double-ended and two single-ended boilers, constructed by the builders. Messrs. Wailes, Dove & Co.'s "Bitumastic" covering was applied to tank tops in boiler rooms.

LAUNCHES—Irish.

Bayern.—Recently Messrs. Harland & Wolff, Belfast, launched a new vessel of 8,250 tons, named the *Bayern*, for the Eastern trade of the Hamburg-America Line. The *Bayern*, which is a sister ship to the *Sachsen*, built by the same firm, will be principally devoted to the cargo traffic, although she will have accommodation for a small number of passengers.

Aracataca.—On January 5th, Messrs. Workman, Clark and Co., Ltd., of Belfast, launched from their South Yard, a new steamer built by them for Messrs. Elders & Fyffes, Ltd., of London. The new vessel has been named *Aracataca*, and is intended for service in the banana and general fruit-carrying trade between the West Indies and this country. The *Aracataca* is 390 ft. in length, with a gross tonnage of about 4,100 and has been constructed under British Corporation Survey for the highest class in their Registry. The cargo holds are specially arranged for the carriage of fruit, being insulated throughout and fitted with ducts for conveying cooled air from the cooler rooms in which efficient plants of refrigerating machinery are installed. Large hatchways give access to the holds, and these are equipped with steam winches and other approved appliances necessary for carefully and expeditiously handling large fruit cargoes. Comfortable accommodation for a number of passengers is arranged amidships in commodious and well-appointed staterooms. The public rooms, which include dining saloon, ladies' sitting-room, and a smoke-room, are all spacious and comfortably furnished apartments. The propelling machinery consists of a set of triple-expansion engines with a complete installation of auxiliaries, steam being supplied by four single-ended steel cylindrical boilers working under forced draught. A "Cochran" Annan donkey boiler with patent seamless furnace has been supplied and fitted.

Anchises.—On January 12th, the new twin-screw steamer *Anchises* was successfully launched from the Belfast shipyard. The *Anchises* is the last of three vessels ordered by Messrs. Alfred Holt & Co., Liverpool, from Messrs. Workman, Clark & Co., Ltd., Belfast, and brings the number of vessels built by this firm for the Blue Funnel Line up to a total of twenty-seven, while they have also in course of construction for this Line a vessel of different dimensions and type. The new vessel, like her sister vessels, the *Æneas* and *Ascanius*, is intended for the passenger service which Messrs. Holt & Co. have recently established between Great Britain and Australia, in which service the *Æneas* has already gained a good reputation for comfort and all-round efficiency. The *Anchises* is 509 feet in length, with a gross tonnage of about 10,050, and complies with British Board of Trade requirements for a first-class passenger certificate. A special feature of these steamers is that accommodation is provided for first-class passengers only, this having been thoroughly thought out to the minutest detail so as to ensure the utmost comfort of the passengers. This accommodation occupies the midship portion of three decks and comprises exceptionally large and airy staterooms, together with a commodious and handsomely decorated dining saloon, a cheerful and well-appointed nursery for the children, a luxurious drawing-room and an exceptionally comfortable smoke-room. The six cargo holds are each capable of receiving the largest type of consignments, such as boilers and machinery, while one of them, together with the after 'tween decks, has been insulated and fitted up for the carriage of frozen meat, dairy produce and fruit. These perishable consignments and the stewards' stores will be kept in good condition by a refrigerating installation on the carbonic anhydride system. Each of the holds is furnished with a large hatchway equipped with steam winches, derricks and other appliances necessary for rapidly loading and discharging cargo. The propelling machinery consists of two independent sets of triple-expansion engines, carefully designed and adjusted so as to reduce vibration to a minimum, and having all the most modern improvements in auxiliaries. Steam is supplied by three large double-ended steel boilers working under forced draught.

TRIAL TRIPS.

Kirkwood.—On January 7th, the loaded trial trip took place of the s.s. *Kirkwood*, built by Messrs. Robert Thompson and Sons, Ltd., of Southwick Yard, to the order of Messrs. Wm. France, Fenwick & Co., Ltd., of London and Sunderland. The speed trials were run and the guaranteed mean speed of 10½ knots was easily attained, the engines running with the utmost smoothness. Mr. J. L. Dawson, who represented the owners, expressed entire satisfaction with the vessel and her machinery. For particulars of Launch see January number.

Wearbridge.—On January 7th, the steel screw steamer *Wearbridge*, built by Messrs. The Northumberland Shipbuilding Company, Ltd., Howdon-on-Tyne, to the order of Messrs. Crosby, Magee & Co., West Hartlepool, for Messrs. The North of England Steamship Co., Ltd., left the Tyne for her official trial trip. The vessel carries about 7,200 tons on a light draught and will steam about 10 knots loaded at sea. The trial trip proved in every way satisfactory. After the trial trip the vessel proceeded to Hamburg under the command of Captain Storm. See December, 1910, issue for description of vessel.

Themistocles.—On January 14th, the *Themistocles*, the new steamer built by Messrs. Harland & Wolff, Ltd., for Messrs. Geo. Thompson & Co., Limited's Aberdeen-Australian passenger and cargo service, left Belfast, after the usual trials, for Cardiff, whence, after coaling, she will proceed to London. The *Themistocles* is a very handsome twin-screw steel steamer of 11,232 tons register, constructed under Lloyd's Survey for the 100 A1 Class, and in compliance with the Admiralty Transport Department and Board of Trade passenger requirements. She is 517 ft. overall, 62 ft. 3 in. beam, with a displacement of about 20,000 tons, and her entrance into the service of this well-known Line has been eagerly anticipated. The motive power is provided by two sets of quadruple-expansion engines carefully balanced to prevent any vibration, and giving plenty of reserve speed so as to ensure strict adherence to time-table dates. The *Themistocles* is constructed on the cellular double-bottom principle, the double bottom extending the whole length of the ship. She is divided by ten water-tight bulkheads into eleven compartments, and so much provision has been made for safety that even if any two of these compartments were simultaneously flooded the vessel would still remain afloat. The vessel is a large cargo carrier, and is fitted with every modern device for the safe and speedy handling of all kinds of goods. Her seven hatches are served by no less than seventeen winches, and powerful electric lights are provided, so that working by night can be carried on as efficiently as by day. The vessel is insulated for the carriage of frozen cargo of all kinds upon the latest principles, the refrigerating machinery being one of Messrs. J. & E. Hall's CO_2 machines. Batteries of coils are provided for the carriage of fruit, and two compartments have been specially adapted for the conveyance of chilled beef—some shipments of which have been successfully brought from Australia to London by the same Company's liner *Marathon*. Although catering for all kinds of cargo, the *Themistocles* is pre-eminently a

passenger ship, and the arrangements made for the comfort of travellers present several novel features of extreme interest.

Harmattan.—Recently the *Harmattan*, the latest addition to the fleet of Messrs. J. & C. Harrison (Limited), of London, left the Tyne after a trial trip which, notwithstanding unfavourable weather, was highly successful. The steamer has been built and engined by Messrs. Swan, Hunter, and Wigham Richardson (Limited), at their Neptune Works, Newcastle-on-Tyne. She is constructed of steel, and is 390 ft. in length by 50½ ft. beam. She will carry over 7,700 tons deadweight on a comparatively moderate draught of water. She has also accommodation for a limited number of passengers. Her engines are on the triple-expansion system, supplied with steam from two boilers working under forced draught. In addition the vessel is provided with all the most modern appliances for the navigation of the ship herself and for the loading and discharging of her cargo. On the trial trip the machinery worked without the slightest hitch. Immediately on the conclusion of the trial the vessel sailed for Cardiff, to complete her loading, under the command of Captain Lamb.

THE "THUNDERER."

AS this number is issued the first Thames-built "Dreadnought" will be launched from the Blackwall yard, The Thames Ironworks, Shipbuilding and Engineering Co., Ltd. Everything is described as complete and there is no reason why the date fixed, the 1st of the month, will fail to see this huge vessel taking to her natural element. She has been nine months in course of construction, the keel having been laid on the 13th April last. In two years from this date she will be completed and will have cost about £1,750,000. The launching ceremony is to be performed by Mrs. Randall Davidson, wife of the Arshbichop of Canterbury. After launching the vessel will be taken to Dagenham, a few miles down the river, and here her machinery, built at the Greenwich works, will be put on board and the guns and armour fitted. She will carry ten 12-inch guns to fire an 850-lb. shell which will penetrate 20-inch armour plate at 3000 yards. A 150-ton floating crane is to be utilized in this part of the work and shops have also been erected for the purpose. The launching weight is about 10,000 tons, against a final one of 22,500. The dimensions of the vessel are 545 ft. long by 88·5 ft. broad. Parsons turbines of 27,000 H.P. will give a speed of 21 knots. It is interesting to note that the *Thunderer* is the namesake of warships that have taken part in prominent actions. A *Thunderer* was in action on June 1st, 1794, in Lord Howe's victory over Villaret Joyeuse off Ushant and the name was also represented at Trafalgar on October 21st, 1805. The first *Thunderer* captured the French warship *Achille* in 1761.

NAVIGATION OF THE AIR.—Aerial navigation has been advanced a stage during the past year, and although the accidents and loss of life have been somewhat heavy and painful, enthusiasm appears to be maintained, "all men think all men mortal save themselves"—albeit such may be tempered with the caution induced by that experience which gives grace to the humble and sense to the foolhardy. The controversy on the patent rights, and the discussions which have been held on the best results of the year will help to place the whole subject on a good basis for the coming year. The death of Octave Chanute has removed one whose designs and suggestive experiments in the pioneering days were valuable to those following on, and by whom they were appreciated. It is interesting to recall the attempts made in 1850 in aerial machines. H. Bell, in July of that year, ascended from Vauxhall Gardens on a machine, the elevating portion of which was of the balloon type, about 50 ft. long by 22 ft. diameter, capable of lifting about 5 cwts. The under body was boat-shaped, fitted with screw propellers, the steering rudder being shaped like a bird's tail. M. Petin (France) also brought out a design of an airship with four balloons, each about 90 ft. diameter, attached to a framework about 480 ft. long by 210 ft. wide; the steering and propulsion were by means of flaps which were actuated mechanically. This great airship does not appear to have reached further than the paper stage.

BOARD OF TRADE EXAMINATIONS.

NOTE—1C denotes First Class: 2C Second Class

December 1st, 1910.

Birrell, J.	2C	Glasgow
Brownless, G.	2C	Liverpool
Cameron, D. M.	2C	Glasgow
Craig, W. M.	2C	London
De Ritter, S.	1C	London
Edridge, C. E.	1C	Glasgow
Eduljee, E. M.	1C	South'ton
Forsyth, A.	2C	South'ton
French, G. H.	2C	South'ton
Gamble, R.	2C	Belfast
Gidman, S. J.	2C	Liverpool
Glass, R.	2C	Leith
Gray, J. G.	2C	Glasgow
Grunnah, N.	1C	Cardiff
Hardy, J.	1C	N.Shields
Harris, P.	1C	Cardiff
Harris, W. E.	1C	Cardiff
Havard, D. L.	2C	N.Shields
Holland, J. E.	2C	Liverpool
Hughes, W. L.	2C	Liverpool
Johns, D. E.	2C	Cardiff
Johnson, C. A.	2C	Cardiff
Jones, R. H.	1C	Liverpool
Jubb, F. M.	1C	Leith
Lee, L. J.	2C	Liverpool
Mackie, D.	1C	Leith
Macdonald, J. A.	1C	Glasgow
Macdonald, J.	1C	Leith
Maller, L.	2C	N.Shields
May, H. W.	1C	Liverpool
M'Chesney, F. M.	1C	Leith
M'Dougall, D. F.	2C	London
M'Leod, A.	1C	Leith
Millar, P.	1C	Leith
Milne, W.	2C	Glasgow
M'Intosh, A. H.	1C	Leith
Neil, W. W.	2C	Glasgow
Nelson, S.	1C	Glasgow
Pattersen, R. A.	1C	Liverpool
Peters, H.	2C	London
Power, W. M.	2C	Cardiff
Rendall, R. O.	1C	Leith
Richards, W.	2C	Cardiff
Roberts, W.	1C	Liverpool
Robson, L. C.	1C	N.Shields
Rogers, W. P.	1C	Falmouth
Scherffenberg, M.	2C	N.Shields
Shaw, A. J.	2C	Cardiff
Shaw, S.	1C	N.Shields
Shirley, J. M.	2C	Liverpool
Thomas, R. R.	1C	Cardiff
Williamson, T.	2C	Belfast
Willis, C.	2C	London
Wyllie, J.	2C	Glasgow

December 8th.

Battersby, S. T.	2C	Liverpool
Birkbeck, J. T.	2C	N.Shields
Bower, F.	2C	N.Shields
Burge, A. J.	2C	Liverpool
Frederick, G. J.	1C	N.Shields
Gracey, J. N.	2C	N.Shields
Johnson, A. W.	2C	N.Shields
Johnson, J. P.	2C	N Shields
Macdonald, C.	2C	London
Newton, C.	2C	London
Nickson, A.	1C	Liverpool
Parry, F. J.	1C	Liverpool
Patrickson, J. S.	2C	N Shields
Peterson, A.	1C	N.Shields
Rees, H. L.	2C	Liverpool
Ridley, W.	1C	N.Shields
Rogers, R. C.	1C	Liverpool
Russell, D.	1C	London
Spence, J.	2C	N.Shields
Sutherland, H. R.	1C	N.Shields
Taphouse, H. W.	1C	London
Thompson, B.	2C	N.Shields
Thompson, J. O.	2C	N Shields
Thompson, R. W.	2C	N Shields
Toward, V.	1C	N.Shields
Weetman, J. H.	2C	Liverpool

December 15th

Avenell, J. P.	1C	London
Ball, W. S.	1C	Liverpool
Barr, R. C.	1C	Glasgow
Burnitt, P.	2C	Hull
Cook, W. P.	2C	Dundee
Crossley, G. B.	2C	Liverpool
Cruickshank, A.	2C	London
Davies, A. S.	2C	Dublin
Duff, W.	2C	Liverpool
Evans, T. C.	1C	London
Fairfoul, R. H.	2C	Dundee
Fettes, J.	2C	Dundee
Fitzpatrick, G. A.	2C	Greenock
Fyfe, J.	1C	Greenock
Guild, C. D.	2C	Glasgow
Hill, H. W.	1C	Liverpool
Hinchcliffe, W.	1C	N.Shields
Hollingum, H. J.	1C	London
Key, F. F.	2C	Greenock
Littlewood, T. N.	2C	Hull
Macdonald, A. M.	1C	Glasgow
Marsden, F. W.	2C	Liverpool
Mather, J.	2C	London
Mathias, J.	1C	Liverpool
M'Hugh, G.	1C	N.Shields
M'Innes, R. R.	2C	Greenock
M'Kenzie, J. J.	1C	Glasgow
Morrison, P.	1C	Glasgow
Parry, J. A.	2C	Liverpool
Reay, W. H.	2C	Dublin
Roberts, A. H.	2C	Liverpool
Scott, H. N.	2C	Glasgow
Stanforth, A. H.	2C	Hull
Thomson, T. H.	1C	Glasgow
Webster, G.	1C	Liverpool
Williams, C. G.	2C	Liverpool
Williams, E.	1C	Liverpool
Wyatt, C. T.	2C	Liverpool

December 29th.

Alexander, A.	1C	N.Shields
Anderson, J.	2C	Glasgow
Anson, J.	1C	Greenock
Baird, P.	1C	Aberdeen
Baxter, A. L.	1C	London
Bower, O.	1C	Glasgow
Bowie, D. B.	1C	Greenock
Burdon, R. F.	1C	N.Shields
Cameron, V. L.	1C	Glasgow
Carrington, H. S.	2C	London
Chaddock, R. G.	1C	Liverpool
Cowley, J.	1C	N.Shields
Cresswell, J. L.	2C	L'nderry
Darling, S. J.	2C	Bristol
Darroch, D.	2C	Greenock
Davies, S. R.	1C	London
Davis, M.	1C	London
Dod, G.	2C	Liverpool
Dunsmuir, J.	2C	London
Fairley, D. M.	1C	Aberdeen
Ferguson, J.	1C	Liverpool
Flint, G. H.	2C	N.Shields
Finlayson, F. J.	1C	Liverpool
Greig, R. F.	1C	Aberdeen
Grimoldby, G.	1C	Hull
Harney, J.	2C	N.Shields
Harvey, R.	1C	London
Hay, W. Y.	1C	Aberdeen
Heasley, M. E.	1C	Liverpool
Hendry, R.	1C	Greenock

Board of Trade Examinations—*continued.*

Hepburn, S. V	2C Liverpool	Coubrough, M.S.	2C Glasgow
Howie, W.	1C Greenock	Dow, W.	2C Glasgow
Hume, E. E. ..	1C Hull	Easdale, T.	1C Glasgow
Humphreys, T.	1C L'nderry	Flucker, G.	1C Leith
Irvine, W.	2C Glasgow	Hart, W. C. ..	2C Glasgow
Johnson, J. W	1C Sunderl'd	Hibbs, R. G. ..	2C Glasgow
Kinnear, T.....	1C Liverpool	Law, A.	2C Glasgow
Lamb, A	1C Aberdeen	Lewis, E. R. ..	2C Cardiff
Lea, J.	1C Liverpool	Mackintosh, F.	1C Glasgow
Lehmann, E. ..	2C Glasgow	Macphail, W ..	2C Glasgow
Lumsden, I. G.	2C Aberdeen	Meiklejohn, R	1C Glasgow
Macne, R.	2C Greenock	M'Laren, A. G	1C Glasgow
Maid, J. M	1C Sunderl'd	Miles, A. P.....	2C Cardiff
Mansergh, W	1C Liverpool	Ormond, J.	1C Glasgow
McMillan, A. ..	1C Aberdeen	Robertson, G ..	1C Glasgow
Melvin, W.	2C Glasgow	Robertson, J. ..	1C Glasgow
M'Kay, W. G	2C Glasgow	Scholefield, R.W.	2C Cardiff
Miller, H	1C London	Scott, N.	1C Leith
Milne, R.....	1C Liverpool	Smith, G. W...	1C London
Mills, W.....	2C N.Shields	Thomson, J. ..	2C Leith
Nelson, R. L...	2C Liverpool	Wilson, C. M ..	1C Glasgow
Northcote, E. S.	1C London	Wallace, J. S..	2C Glasgow
Peters, D. B. ..	2C Aberdeen		
Purdie, P. ..	2C Glasgow		
Rogers, R. A...	2C Hull		
Robinson, S. A	1C N.Shields		
Salmon, H. E.	1C Sunderl'd		
Simpson, A. ..	1C Aberdeen		
Smith, C. P. ..	2C N Shields		
Soulsby, J. D	1C Liverpool		
Swinburne, R	2C Sunderl'd		
Trewern, W. ..	2C Bristol		
Ward, T.	1C Glasgow		
Webber, D.....	1C Hull		
Willoughby, J. H	1C L'nderry		

January 5th, 1911

Baillie, J. B. ..	2C Glasgow
Clews, A.....	1C Glasgow

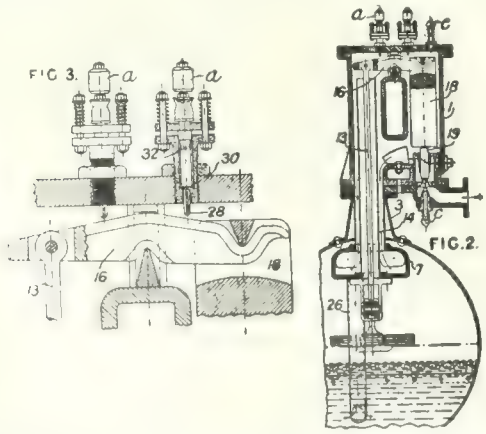
January 12th.

Evans, D	1C Liverpool
Gilling, J. C ..	1C London
Hamilton, W...	2C Greenock
Hardcastle, W. J	2C Hull
Johnson, J. H	1C Hull
Macbeath, J. ..	1C Liverpool
M'Kibbin, R ..	1C Dublin
M'Morran, J. ..	1C Dublin
Renton, D. H	2C London
Spofforth, W...	1C Hull
Thompson, W.	2C N.Shields
Thornton, J. ..	1C Liverpool
Weatherilt, W	2C N Shields
Wilkie, A.	2C Greenock
Wilson, C	2C Liverpool

The Marine Engineer and Naval Architect Patent Record.

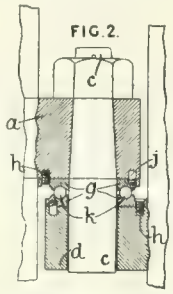
Compiled by Messrs. E. P. Alexander & Son, Chartered Patent Agents, 306, High Holborn, London, W.C.

20,219. Steam-generators. Edge, J. Feed-water, supplying and controlling.—Relates to float-controlled feed-regulators and high and low-water alarms for steam-generators, so arranged that if the feed-valve sticks the alarm is not prevented from acting. The feed-water enters the boiler



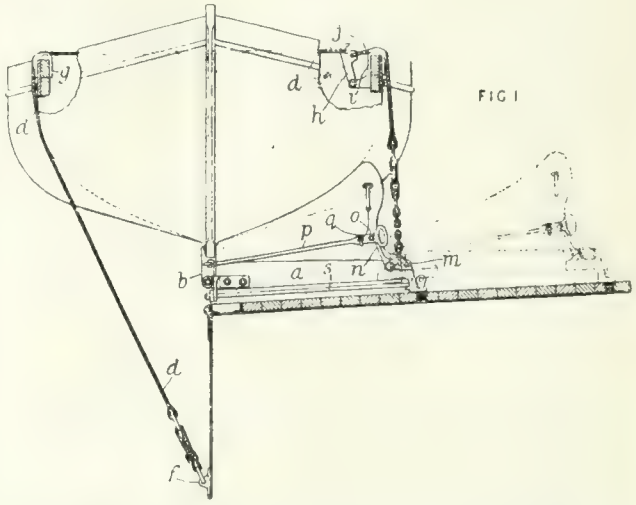
through openings in the top of a box 7 suspended by a pipe 6 from a stand-pipe 3 on the boiler; the water may also pass from the box 7 by a pipe 26 to the space below a partition in the boiler. On the stand-pipe 3 is mounted a casing 1 containing a lever 16, to one arm of which is attached a balance weight 18, which presses on and so closes, without being attached to, the inlet valve 19. The other arm of the lever 16 is connected by a rod 13 to a balanced float-lever in the boiler. A pipe 14 concentric with the pipe 6 protects the rod 13 from the feed-water and admits steam to the upper part of the casing 1, thus preventing water-hammer and supplying steam for the whistles *a*. Handles *c* are provided whereby the mechanism may be operated to move the valve in case of its sticking. The lower parts of the whistles *a* are formed as valves 30, Fig. 3, and when these valves are lifted off their seats by the lever 16 coming in contact with the ends 28 of the whistles, steam is admitted to the whistles through the openings 32.

21,378. Ships' rudders. Forster, T. S. Ball or like bearings are arranged in connection with a series of pintles and gudgeons on rudders and stern-posts to prevent excessive pressure on the lowest pintle, and to reduce friction. As



shown, the balls *k* are arranged between renewable races *g*, secured by screws *h* and pins *j* to gudgeons *a*, *d* on the rudder and post respectively. A securing-pintle *c* passes between the gudgeons *a*, *d*. Roller bearings may replace the ball bearings.

21,629. Boat supporting and securing gear. Welin, A. Relates to means for releasing simultaneously the inner and outer gripes by releasing a single slip hook pivoted at the inboard end of the supporting-chock. The outer gripe *d* is attached to an eye *f*, secured to the vessel below the boat, and, passing over a saddle-piece *g*, is hooked on the upper part of a lever *h*, which is jointed to a saddle-piece *i*. The



inboard gripe *j* is secured to an eye on the lever and retains it in a vertical position, the lower part of the gripe being hooked over a lever *m* hinged to the chock *a*. The lever *m* is provided with a finger *n*, which normally takes against a stop-pin *o* carried by a tension rod *p* which keeps the keel rest *b* in position. The rod is locked by a pin *q*, and on removing this, the finger *n* falls away and releases both gripes. The chocks slide athwart-ship, and are mounted on rails *s*. The gear may be used in combination with the quadrant davits described in Specification No. 23,324, A.D. 1900.

The Marine Engineer
And Naval Architect.
LONDON, MARCH, 1911.

THE PORT OF LONDON.

THE question has often been asked in commercial circles during the past two decades on the matter of dock accommodation, "Why should London wait?" particularly bearing in mind the rapid and extensive development that has been taking place in many competitive Continental ports, such as Antwerp, Rotterdam, Amsterdam and Hamburg, while at the same time shipping business has materially increased at our home ports, such as Liverpool, Southampton, Hull and Bristol. Great difficulty has been experienced in finding a rational answer to this important question. It will be remembered that the Port of London Authority was created in 1908, and was given the control of the River Thames from Teddington to a point fifty-one miles east of London Bridge, and the main object of its creation was to develop as far as possible the great potentialities of the river, so as to retain for London the position of the greatest port of the world, by remedying the disabilities under which the docks on the river lie, owing to the fact that for the past twenty-five years nothing has been done to march with the times in meeting altered conditions. When the first annual report was published last year, a feeling of considerable disappointment was experienced owing to the extremely meagre improvements which were outlined as in contemplation. Recently, however, the chief engineer to the Authority, Mr. F. Palmer, has presented his report, which, after careful perusal, one must agree contains a comprehensive policy of a progressive and far-seeing character. The result, as represented by the report, of the fifteen months' study of the intricate problem by the experts of the Authority will, we feel sure, be recognised as eminently satisfactory by all those who take a broad-minded view of such a great and important question as the position of London as a trading port. The scheme as a whole is a far-reaching one, and will ultimately involve an estimated expenditure of about fourteen-and-a-half millions sterling, and having regard to the experience of the estimates for such work in the past, it is quite reasonable to assume that the ultimate cost may be nearer twenty millions. The question always arises in one's mind whether, after such a long period of inactivity as has taken place and trade has been largely diverted, developments even on the large scale suggested will reinstate London in her old comparative position as a port. However, everyone recognises something must be done, and after a careful outline of the complete scheme on a broad basis, the sooner it is started on the better. The scheme may be divided into three distinct stages, involving an expenditure of four millions, five-and-three-quarter millions and nearly five millions respectively, and the proposals in each stage are in every sense a necessity, but as they will no doubt be dealt with successively, for financial reasons, the succeeding stages may be modified as time goes on to comply with new conditions which present themselves. It is interesting to note the views of the Chairman of the Authority, Lord Devonport, in a statement issued when presenting the report, that since 1886 the increase in the average size of the largest vessels represents a growth in length from 450 ft. to 700 ft., or 55 per cent.; in beam from 52 ft. to 77 ft., or 48 per cent.; in draught from 28 ft. to 35 ft., or 25 per cent.; and in gross tonnage from 7,000 to 24,000, or three and a-half times greater. Further, the volume of shipping using the Port of London itself has grown from a nett registered tonnage of under twelve millions to over eighteen millions. On those facts the Chairman expresses the view that the need for immediate action is overwhelmingly apparent. Dealing with the proposal in detail, the first stage includes the construction of a new dock, at the cost of £2,340,000, south of the Albert Dock, of 65 acres area to accommodate the largest ship afloat or projected, and in this connection it may be stated that Mr. Palmer has in his mind vessels 1,250 ft. long. The quayage will be 9,200 lineal ft., the depth 44½ ft., the width 700 ft. at the east and tapering to 500 ft. at the west end, and the length 4,600 ft. A graving dock 1,000 ft. long, 110 ft. wide and 38 ft. deep on the blocks is to be built in connection with the proposed south dock, while a connecting channel between the proposed dock and the Albert Dock at the east end is to be provided, allowing vessels 650 ft. long to pass from one dock to another. On the north side of the Albert Dock a new dock is to be constructed, and it is proposed to spend a quarter of a million on preparatory work. At the West India Docks it is proposed to spend £960,000 in constructing a new entrance 575 ft. by 800 ft. and 40 ft. deep, with an additional depth of 2 ft. by means of pumping, and in making the South Dock capable of taking ships 550 ft. long, or twice the tonnage at present admissible, so as to encourage tramp steamers of large size. Parallel to the entrance a dry dock of corresponding dimensions will be constructed, as in the opinion of the Chairman the absence of suitable dry docks not only involves a loss of revenue to the Authority, but also a serious loss of trade to the port, owing to ships having to go elsewhere for repairs. With reference to the London Docks a sum of £335,000 is to be spent in widening the passage known as the "Tobacco" Dock, connecting the Eastern and Western Docks, in order to make a better entrance to the latter 60 ft. wide and 25½ ft. deep. The berth accommodation is to be greatly improved, and a new jetty in the Western Dock is to be

provided. An expenditure of £12,700 is contemplated at the Millwall Dock in connection with the extension of the existing dry dock to a length of 550 ft. Although nothing is included for riverside jetties in the first stage, it is interesting to note that the Chairman states the omission is in no sense an indication that such schemes are not deserving of the most careful consideration of the Authority, but at the moment there is no available site where such accommodation could be provided; but it is possible that in the near future some suitable position may become available where the demand for riverside berths as distinct from dock accommodation may be tested. We will deal with the remaining stages of the work in a future issue.

THE LOSS OF THE *WARATAH*.

AFTER a most lengthy enquiry of so exhaustive a nature as the circumstances of the case would admit, the Court have now given their decision in the form of answers to the questions submitted. Having regard to the exceptional circumstances of the case and the deep interest aroused by it, the Court suggested to the Board of Trade the advisability of reading extracts from the report which the Court had prepared for the Board, and the latter acquiesced in this unusual course, and we think rightly, having regard to the varied character of the material placed before the Court in the matter of evidence. The findings of the Court were as follows: 1. The vessel had three Lord Kelvin Compasses, and so far as the Court could learn they were in good order and sufficient for safe navigation. 2. When the vessel left Durban on July 26th, 1909, (*a*) she was supplied with proper and sufficient boats and life-saving appliances, in good order and ready for use; (*b*) she was manned considerably in excess of Board of Trade requirements, but in the opinion of the Court an early opportunity might be taken of reconsidering whether these requirements are sufficient in the case of large ships carrying passengers; (*c*) the Court was of opinion that the cargo was properly stowed; and (*d*), on the basis of the calculations made by expert witnesses, with the results of which the Court was in general agreement, the vessel had sufficient stability as laden. She was in proper trim for the voyage she was about to undertake. She was in good condition as regards structure and, so far as the evidence went, in a seaworthy condition; but there was not sufficient evidence before the Court to show that all proper precautions, such as battening hatches, securing ports, coaling doors, etc., had been taken. 3. The cost of the ship to her owners was in round figures £154,000, and the insurances were—on hull and machinery £135,000, on disbursements £15,000. 4. So far as th Court had been able to ascertain, the *Waratah*, after having been spoken by the *Clan Macintyre*, was not seen or spoken by any other vessel. 5. The cause of the *Waratah* not having been heard of after being sighted by the *Clan Macintyre* on July 27th, 1909, was her loss during the gale on July 28. The precise manner of her loss could not be determined upon the evidence available. After the investigation that has been made, and the character of the evidence available, it will be conceded that the nature of the Court's findings are what one could only reasonably expect under the circumstances, and it is a satisfactory feature that the Court have stated their opinion that there was no reasonable doubt that whatever the cause all the passengers and company of the vessel met their deaths at sea soon after she left Durban. The Court regarded it as the kindest course to emphasize this view in the strongest possible manner, which view will be agreed to by all level-headed people. From the report to the Board of Trade it is clear that the Court would have liked to have had some further explanations as to the correspondence which took place between the owners and builders, and an unpleasant impression was clearly made on the Court owing to the absence of any reference as to the seaworthiness of the ship in the captain's correspondence. A suggestion that a committee of experts should be appointed to settle the conditions of the stability of ships in different trades is worthy of the most serious consideration.

Institute of Marine Engineers.—On March 20th, Mr. Shackleton will read a paper on "Modern developments in British and Continental oil engine practice."

The Electric & Ordnance Accessories Co., Ltd., have found it necessary to appoint an engineer to represent them exclusively in Yorkshire, and have been successful in securing the services of Mr. F. MacCallum, late of Messrs. J. P. Hall and Co., Oldham. Mr. J. Booker now confines himself to the Lancashire district.

Speed Trials of the French Dreadnought "Condorcet."—The speed trials of the French battleship *Condorcet* were carried out on the 13th January last. The vessel has a displacement of 18,000 tons and a shaft horse-power of 22,500. She is fitted with twenty-six Niclausse boilers of the latest improved type, made by Messrs. J. & A. Niclausse, of Paris, and eight turbines built in a French dockyard. The *Condorcet* is the first French "Dreadnought" to carry out speed trials. The full power trial, as provided for in the contract, consisted of a run of ten hours with all boilers in use, and burning 26½ lbs. of coal per square foot of grate surface per hour. The result of the trial gave an average speed under the above conditions of 19·257 knots as against 19·23 knots provided for. The Naval Ministry further asked Messrs. J. & A. Niclausse if they would consent to a full-power trial with a combustion of 33-34 lbs. of coal per square foot of grate, which was accepted. The trial under these conditions was carried out on the 16th January, and the average speed attained over a ten hours' run was 19·80 knots, more than half a knot over the contract speed. The *Condorcet* further carried out her endurance trials on the 20th and 21st of January. This trial consisted of a run of twenty-four hours with normal combustion, and the average speed attained was 18·2 knots, with a coal consumption per mile lower than was allowed for in the contract. The performance of the turbines and boilers was perfectly satisfactory throughout all the trials, the desired steam pressure being easily maintained under all conditions.

and there is no doubt that efforts will be made to progress as much as possible with her before the close of the current financial year, seeing that the Estimates provide £10,200 for labour on the vessel. It will, however, be impossible to expend that amount in so short a time—less than five weeks. The preparations made with a view of starting the vessel have been very extensive, and she will make unusually rapid headway once she is laid down. The contract of the Parsons Marine Steam Turbine Company, Ltd., of Wallsend-upon Tyne, has been provisionally accepted for the turbine pro pelling machinery of 18,000 shaft horse-power for the *Amphion*. The trials of the cruiser *Blonde* are now being carried out. The steam and gunnery trials are to be completed by March 4th and on the 6th the anchor, circle and turning trials are to take place. The vessel will afterwards return here to be completed. It is expected that when the *Blonde* is completed her cost will compare most favourably with the other vessels of the class. For instance, the ventilation system will, it is said, have cost about £2,000 less than it did for the cheapest of her sister vessels.

WATT ANNIVERSARY CELEBRATIONS.

THE customary celebrations of the anniversary of the birth of James Watt were held as usual in the last week of January, and took the form, in Greenock—Watt's birthplace—of the "Watt Lecture," delivered under the auspices of the Greenock Philosophical Society; and, in Glasgow, of the anniversary dinner under the auspices of the Institution of Engineers and Shipbuilders in Scotland. The Watt Lecture was delivered on the evening of January 20th by Prof. J. Harvard Biles of the Elder Chair of Naval Architecture in Glasgow University; while the dinner was held in St. Andrew's Halls, Glasgow, on the evening of January 26th. The lecture had extra significance on account of its being delivered in the jubilee year of the Greenock Philosophical Society; and the dinner was notable on account of its being the largest gathering of the kind ever held under the auspices of the Scottish Institution. The subject of the lecture was "The Modern Battleship," which, Prof. Biles said, "owed its importance so largely to James Watt and to those who had taken advantage of and developed the results of his work." The major and more weighty part of the address was virtually a reasoned defence of the policy of building "Dreadnoughts," and an appraisement of the fighting value of such a mechanism as a heavily-armoured battleship in modern warfare. After having reviewed in its essential features the evolution of the British battleship, from the *Warrior*, built in 1861, to the latest example, the lecturer said there were at present twenty-two British "Dreadnoughts" built or being built, and five others were to be laid down immediately. About sixty foreign "Dreadnoughts" were built or in hand. The departure from the type of ship having only four guns of large calibre, and the adoption of that of the "Dreadnought" had led to great expenditure on new ships. The eighty-seven "Dreadnoughts" built or being built would cost little short of 200 million sterling. The lecturer then considered in some detail the cause of this development as exemplified in (1) all big-gun one-calibre ships; (2) increase in size of ships and the considerations affecting these two heads. Dealing with the position of guns in battleships, Professor Biles said that in the *Colossus* the arrangement permitted of all the ten guns being fired on either broadside, of six being fired ahead, and of eight being fired astern. In the *Monarch* the arrangements permitted of all ten guns being fired on the broadside, four ahead and four astern. It was true that the arc of training near the broadside position was, in the average, larger in the latter than in the former case, but for chasing a weaker fleet of about the same speed it would seem as if the earlier ships had a better chance than the later ones.

The large company attending the Watt Dinner was presided over by Prof. Archd. Barr, president of the Institution of Engineers and Shipbuilders, amongst those supporting him being:—Lord Lamington, the Marquis of Graham, Lord Blythswood, Sir J. H. A. Macdonald, Sir Gerard A. Muntz, Bart., Sir John E. Bingham, Bart., Rear-Admiral J. E. Bearcroft, Col. J. M. Denny, Mr. Alex. Siemens, Sir Thos. Mason, Dr. S. J. P. Thearle, Mr. J. T. Milton, Col. Saxton White, Mr. Jas. Gilchrist, Mr. Thos. L. Devitt, Mr. Francis Henderson, Mr. Summers Hunter, Dr. Robt. Caird and Mr. Thos. Bell. After the usual loyal toasts had been honoured, and that of "The Imperial Forces" fittingly proposed by Lord Lamington and responded to by the Marquis of Graham, the president—quoting the inscription by Lord Brougham on James Watt's monument in Westminster Abbey, which runs: "Not to perpetuate a name which must endure while the peaceful ants flourish," etc.—intimated that it was their custom at that annual function to honour the toast of "James Watt" in solemn silence. After this had been done in some moments of impressive stillness, he announced that a cable had been received from their engineering friends in Japan which stated: "The Steam Users of Japan are holding their James Watt dinner to-day, and they send their greetings and good-will to their Scottish *confrères* who are celebrating the anniversary of the great inventor." To this, the following response had been sent: "The Engineers and Shipbuilders in Scotland send hearty greetings to their *confrères* at Tokio on the occasion of their assembling to do honour to the memory of James Watt, and trust that the cordiality of the feelings existing between the two societies may long continue."

Sir J. H. A. Macdonald proposed the toast of "Engineering Interests" in a very racy manner and full of interesting allusion to the engineering progress of the past. The engineers of to-day, and particularly the younger of them, were so extremely busy that they had very little time to read history; but there were lessons to be drawn from the past which should always be remembered, and he thought they should clearly realize one of these; that if they were to make progress in the great arts and the great powers of engineering, they should not allow themselves to be cold-watered, either by the great engineers who had gone before them or by an apathetic public. He then gave a number of illustrations of how even great men could wrongly dogmatise and damp the ardour—possibly the prescience—of the young, and he counselled his hearers not to put off anything they were working at merely because some great big man said it would not succeed.

Mr. Alexander Siemens, president of the Institution of Civil Engineers, who replied, referred to Sir John Macdonald's remarks on the restricted and inaccurate views of some great engineers and scientists in the past on particular subjects, and agreed with the advice he gave as to young men not being deterred in any project or line of investigation solely because of some big man's dogmatism. Mistakes had been made by great engineers undoubtedly, but this had been largely due to the dearth of facilities for exchange of ideas and proved fact. The certainty and speed of communication and the saving of manual labour were two immense forces which were not in the old civilization, and the consequences had been that the old civilizations, not only of the Romans and the Greeks, but of the Egyptians and the Babylonians, perished altogether. They had no means of communicating their knowledge to other peoples, nor could they preserve it from being destroyed. It was engineering which had made present civilization absolutely safe. In this way engineering interests were the interests of the whole world.

Messrs. Leonard Chapman & Co., Ltd., Importers and Manufacturers, Munton Road, London, S.E., report:

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,, chips ,, ..	8 15 0	to 27 10 0	,,
,, dust ,, ..	10 0 0	to 25 10 0	,,

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Ceylon, 97% to 99%, f.o.b. London	50 0 0	to 63 0 0	per ton
,, 90% to 91% ,,	40 0 0	to 42 0 0	,,
,, 80% to 81% ,,	30 0 0	to 32 0 0	,,
,, 70% to 71% ,,	27 0 0	to 28 0 0	,,
American large flake, f.o.b. London	45 0 0	to 49 0 0	,,
,, small ,,	35 0 0	to 45 0 0	,,
Joint Compd. per cwt.	2 9	to 2 12 6	
Paint Paste	2 2	to 2 5 0	
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"HOLZAPFEL I."
GAS-DRIVEN CARGO VESSEL.

THE new enterprise in utilizing the suction gas engine for marine purposes was practically inaugurated at South Shields on Thursday afternoon, the 16th of February, when the *Holzapfel I.* was launched to the order of the Holzapfel Marine Gas Power Syndicate, Ltd., from the yard of Messrs. J. T. Eltringham & Co., South Shields, in the presence of a large gathering of engineers, shipbuilders, and others interested in the new departure. The Mayor and Mayoress of South Shields were present, and among others Mr. and Mrs. A. C. Holzapfel (of Petersham), Mrs. Max Holzapfel, the Misses Holzapfel, Mr. and Mrs. A. G. Holzapfel (Newcastle), Mr. D. W. Fitzgerald and Mr. A. F. Fitzgerald (representing the builders), Mr. Weil ((Stockton), Mr. Archer (Stockton), Mr. T. Westgarth (Middlesbrough), Mr. Eyres (Sunderland), Mr. H. J. Rowell (Messrs. Hawthorn, Leslie and Co.), Mr. G. B. Richardson (Messrs. Swan, Hunter and Wigham Richardson, Ltd.), Mr. Harrison (Lloyd's principal surveyor), Mr. James Skinner (Bill Quay), General Kasey (Russian Volunteer Fleet), Mr. J. Dill Rossa (Odessa), Capt. Lord (Ship Owners' Society), Mr. J. Trail (Newcastle), and many others.

The *Holzapfel I.* is a small coaster vessel, but it is intended, Mr. Holzapfel told the gathering after the launch, to build one six times the size before the year is out. It is 120 ft. by 22 ft. by 11 ft. 6 in. moulded, and is intended to carry 300 tons deadweight on a draught of 10 ft. For the engines two generators each of 100 h.p. are provided and two vapourisers or scrubbers. The whole gas plant is raised on a gas-tight platform 3 ft. 9 in. above the keel of the vessel and enclosed by gas-tight bulkheads. The two producers stand side by side and are each 3 ft. 6 in. square, their fronts forming part of the bulkhead. The vapourisers are at the back of the producers, the two scrubbers are about 11 to 13 ft. high and 2 ft. 6 in. diameter each, the upper portion being the wet portion. The cooling water and the circulating water for the engines are obtained from a tank fixed on the poop deck supplied by pumps which can be worked either by the main engines or by a separate paraffin engine. The cooling water, on passing from the scrubbers, flows into a tank placed directly underneath them, and is thence pumped overboard by a separate pump driven by the main engine. The cooling water for the cylinders flows overboard by gravitation. The water for the vapourisers is obtained from the after-peak tank, whence it gravitates or it can be pumped by a hand pump into a small tank mounted above the generators. A gas-tight door is fitted to the space containing the gas plant and it is not expected that this space will have to be entered while the vessel is at sea. Blow-off pipes are fitted to each generator, the valve of which will be opened before the engines are stopped. A piece of flexible pipe is fitted between each producer and the scrubbers so as to prevent leakage through straining. The space in which the gas plant is contained is separately ventilated by two 12-in. ventilators having induced ventilation by a small pipe supplying compressed air from the air compressors. As the fronts of the producers are facing the engine-room it will be seen that no leakage of gas can get to the fires and that the danger of an explosion is thus avoided. The whole of the gas plant is by the Power Gas Corporation of Stockton-on-Tees, and the gas engines are by Messrs. E. S. Hindley and Sons, of Bourton, Dorset. They are of 180 brake h.p., having six cylinders 10¾ in. in diameter and 10 in. stroke. They are intended to run at 450 revolutions per minute, which will be reduced by the transformer to 120 revolutions of the propeller shaft. The ignition is by low-tension magneto and by Sir Oliver Lodge's system with accumulators, a small dynamo being provided for recharging the accumulators. The vessel has a donkey boiler 5 ft. diameter and 8 ft. 6 in. high and two steam winches of two tons capacity each. The bunker is of 12-tons capacity and is situated between decks. The estimated consumption of coal is 28 cwt. of coal per twenty-four hours and the speed about 7½ knots. The *Holzapfel I.* is to be chiefly employed carrying coals from ports in South Wales, at which anthracite coal, which is needed, is always obtainable.

Mrs. A. C. Holzapfel christened the vessel as it left the ways, and was afterwards presented by Mr. D. W. Fitzgerald (on behalf of the builders) with a souvenir of the occasion.

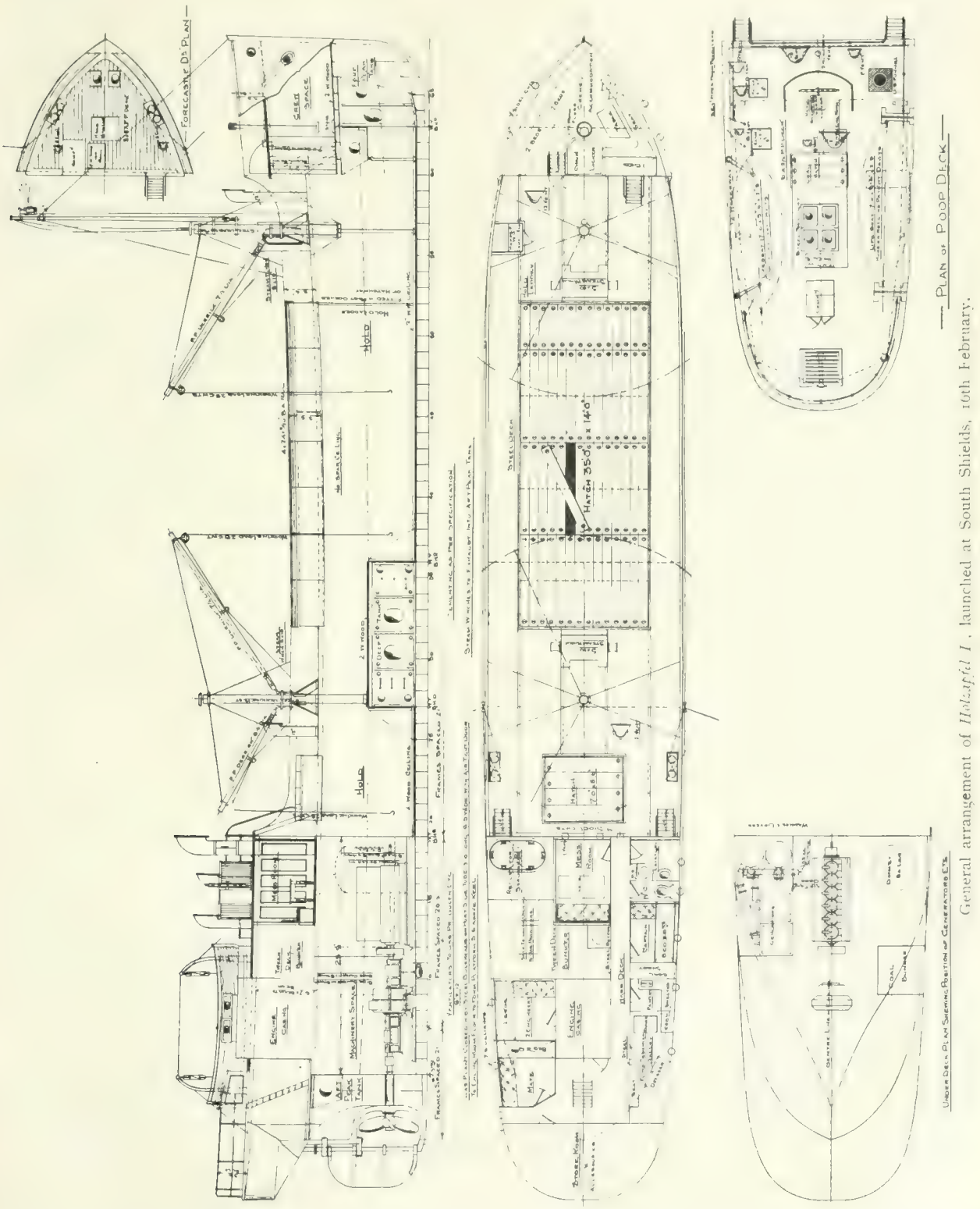
Mr. D. W. Fitzgerald, in proposing "Success to the *Holzapfel I.*," in the offices of the builders later, said their shipyard by reason of the older establishment of the boiler works was rather overshadowed in the firm's enterprise, but as a matter of fact since 1864 they had in their shipbuilding yard turned out an average of six vessels every year. The first vessel launched was from the slips from which the *Holzapfel I.* had just been loosed. In their boiler works they had been associated with all the changes in marine engines and were glad to be associated in this important new departure. Through the enterprise of Messrs. Holzapfel & Co. suction gas was now to enter into the competition. They wished the firm great success in their new enterprise. They had, he thought it might be interesting to state, installed in their boiler works suction gas engines of 150 brake h.p., and their consumption for a normal week's work was three tons of coal for the two engines. In an ordinary way for steam purposes that would require 15 tons per week, but the cost of this coal was about two and a half times that of steam coal. Still there was enormous economy. Touching on commercial matters he said he agreed with the recent letter of Lord Furness in the *Times*, which re-echoed what the Prince of Wales said when he came back from India, "Wake up, England." Workmen were more highly organized, were getting better wages and though that might affect manufacturers' profits he held it was better for the State. He was proud, he said, to be associated with Messrs. Holzapfel in this new enterprise, and returned thanks for the able assistance given them by Mr. Cole, the naval architect.

Mr. A. C. Holzapfel, in reply to the toast, said he ventured to think that few realized how much was bound up in their good wishes to the success of the *Holzapfel I.*, the first sea-going gas-driven cargo vessel afloat, and of what very great local and national importance this new departure might ultimately prove. Those who read the technical press, and even those who gave their attention to the many articles on these questions appearing from time to time in the daily press, would have realized that the steam engine and the steam turbine were not likely to be the motive power of ships in the almost immediate future, and that the internal combustion engine was bound to take their place on account of the many advantages which it was capable of bringing. He proceeded, "When we speak of the internal combustion engine for sea-going vessels, we have for economical reasons to consider only two types; the Diesel type of oil engine, consuming heavy residual oils, and the gas engine. We are at this moment at the parting of the ways; shipbuilders, shipowners and engineers will have to decide to which of these types they had best give their attention, for it is the type to which most attention is given, and which is backed up most by brains and money at this time, which will be universally adopted."

There were, he said, some important and undeniable facts which should be carefully weighed by shipowners and engineers before they decided which one of the roads they were going to take.

"You are all aware that the oil required for heavy oil engines is obtained from raw petroleum and is, in fact, a residual oil of petroleum after the lighter oils, like benzine and kerosene, have been distilled off. So far no oil is being produced in these islands except that which is distilled off shale coal in Scotland, and comparatively little in our colonies, the only colony producing oil in appreciable quantities being British Burmah. The great oil-producing centres at the present moment are three—the United States, the South of Russia and East Asia. The first of these fields is very largely under the control of the Standard Oil Company, the second and third are controlled more or less by what is known as the Rothschild group and, although this latter does not exercise such a direct control as the Standard Oil Company, it would have no serious difficulty in making its control over these two fields a practical and effective one. The residual oils required for internal combustion engines are not present in the American petroleum to so large an extent as in the Russian and East Asian oil and for this reason, if our Navy should adopt oil engines, it would be dependent for its supplies very largely upon Russia and the Far East. The Russian oils would have to come through the Dardanelles and Bosphorus, which in case of a European war might easily be seized and blocked by a Continental power. The Eastern supplies would have to come through the Suez Canal, and the question whether this might be blocked in case of

war has often been discussed and considered. If, therefore, our future battleships, cruisers and torpedo catchers were dependent on Eastern Asia and South Russia for supplies of oil, and particularly if they are to be propelled by oil engines, they might, in case these supplies were cut off, be dependent for their oil on our respected relative, Uncle Sam. I need hardly say that in that case we would probably be up against a corner in oil which would quickly shatter the finances of this country. It has been suggested that for the eventuality of a war about a million tons of heavy oil could be stored in storage tanks and that this would be sufficient to provide our Navy with oil for a year's consumption; but



General arrangement of *Hohenfels I*, launched at South Shields, 16th February.

we have no assurance that a Naval war, for instance, against Germany, would be over in a year; besides, such storage tanks might readily be blown up with dynamite, particularly now that aviation has to be taken into account in questions of future warfare."

"So much for our Navy. But now, coming to the Merchant Marine, I have already indicated that the petroleum production is more or less under the control of two powerful groups. These are sometimes in competition; at others they work on friendly terms. If at any time they should amalgamate or form a trust, woe betide shipowners who would depend upon their supplies of oil on an oil trust!

"The alternative road is that of the gas engine—the gas being produced from coal, of which we have an unlimited supply in this country and of which our colonies (Canada, South Africa, India and Australia) have also large and important supplies. At present the cost of driving a vessel by coal gas comes out considerably cheaper than by oil, but this advantage is partially outweighed by other advantages possessed by oil engines. However, we know one thing, that is, that we have so many millions of tons of coal underground, whereas the oil strata can never be measured and one never knows when an oil well is going to give out. I might here mention that some six or seven years ago £250,000 of British money was subscribed for a petroleum refinery in California; the refinery was built and a pipe line laid to the oil field. When all was ready the oil wells suddenly gave out and the refinery has become practically valueless in consequence. This shows you how unreliable a supply of oil is. Moreover, a ship with oil engines cannot be readily adapted for being driven by gas power, whereas a ship with gas engines can, at comparatively small expense, be adapted for using oil.

"I am surprised that the coal owners of this and other districts have not realized the importance of the new departure which is facing us, and have not taken any steps to advance their claims for consideration, while no end of people and newspapers are advocating oil engines. I hold no brief for the coal trade of England, but I can say this, that British coal is pre-eminently suited for making power gas. We have very large and important coal strata giving dry non-caking coal which contains comparatively little tar, while most of the foreign coals are of the caking type and rich in tar, the extraction of which from power gas absorbs some power and is apt to cause some difficulties.

"Another most important point is this, that the oil engine obtains from oil practically all heat energy possessed by the oil, while the gas engine so far obtains considerably less than half the heat energy contained in coal. The gas engine and gas power plant are, therefore, capable of enormous improvement, and I look to our marine engineers to do for gas what in the past they have done for steam. It is for Great Britain and her marine engineers and her capitalists to solve this task, and I hope we shall rise to the occasion."

The question of gas *versus* oil, he repeated, was of the greatest national importance, and every patriotic Briton should realize this and do his best to avoid committing the nation to the necessity of depending for the propulsion of their ships on oil produced in foreign countries, which might not be available in case of war and which may be entirely controlled by some huge international trust.

INSTITUTION OF NAVAL ARCHITECTS.—The Council have pleasure in informing the members of the Institution that His Majesty the King has been graciously pleased to approve the grant of a Royal Charter of Incorporation. The annual meetings of the Institution will take place on Wednesday, April 5th, and the two following days in the Hall of the Royal Society of Arts, John Street, Adelphi, London. The annual dinner will be given on April 5th at 7.30 in the Grand Hall, Connaught Rooms, Great Queen Street, Kingsway, W.C.

HAWTHORN'S MARINE ENGINEERING ACADEMY.—At the January examination held in London for extra first-class engineers of the four candidates presenting themselves, Mr. D. R. Roy and Mr. W. Turner were the only successful candidates. Both these gentlemen were prepared by Mr. J. Hawthorn, of Hawthorn's Engineering Academy, 41, East India Road, and both being successful at the first trial, this makes eighty-two successful candidates prepared from this old-established academy.

INTERNAL COOLING SYSTEM FOR INTERNAL COMBUSTION ENGINES.

A NEW system of internal cooling for internal combustion engines is illustrated in Figs. 1 and 2, showing a gas engine arranged for such internal cooling. In Fig. 1 the main piston, on its expansion stroke, is on the point of over-running an exhaust port located at *b*. When this port is uncovered combustion products escape through it, and at the same moment the small auxiliary piston is driven into the cylinder up to about the position shown in Fig. 2. Meanwhile the main piston has completed the expansion stroke. The auxiliary piston assists in expelling the products of combustion and draws behind it a cooling fluid, air or sprays of water, converted into steam. Assuming the engine works on a 4-stroke cycle, the main piston will next make the exhaust stroke, whilst at the same time the auxiliary piston returns to its original position, thus removing the cooling fluid.

During the compression and explosion strokes the auxiliary piston bears against a solid annular seating provided at the end of the cylinder and makes a tight joint therewith. Several advantages are thereby secured, namely, the driving mechanism can be built light, as it has not to bear any pressure, and the piston can be made short and light, because its packing ring or rings are not mainly depended upon for an explosion tight joint.

A number of stiff springs projecting from recesses in the annular seating back up a buffer ring against which the auxiliary piston contacts on its out-stroke, so that it is not brought to rest against a dead stop. The auxiliary piston retains this position until the resistance of the elastic buffer ring is overcome by the gradually rising compression pressure. The piston is thereby brought to rest without shock, and during exhaust and suction there is no clearance in the cylinder, so that practically all products of combustion are expelled.

Fig. 1

Fig. 2.

There are numerous means for actuating the auxiliary piston, but as they present no special difficulties, a description may therefore be omitted.

For small powers the cylinder may be left open to the atmosphere, as the air following after the in-going piston will provide adequate cooling. Where air is insufficient water may be sprayed from the end of the cylinder after the in-going auxiliary piston; the cylinder should be closed up behind the auxiliary piston. The water may be fed to the sprays by gravitation and its flow may be controlled by a slide valve contained in the supply pipe and actuated by the main shaft or half-speed shaft. The sprays may be arranged at the end of the cylinder, or in a position where they are covered by the auxiliary piston when it is in the rest position. By the application of a pump of the type used in the "Combined Cooling and Scavenging System," described in the February number of "*The Marine Engineer and Naval Architect*," the sprays may be transferred to the piston rod or to the piston. The water may also be sucked in the vacuum formed by the in-going piston.

The sprays of water will be instantly converted into steam, which may partly condense if spraying is continued during a longer period. The most severe heat conditions can thereby be dealt with successfully, in spite of the short time available; the steam generated being allowed to issue continually.

The duration of the cooling action is for the combustion chamber and adjacent areas about that of one stroke in four-stroke cycle engines, a little less in two-stroke cycle engines. For the cylinder areas farther removed the time for cooling decreases in about the same degree as the need for cooling decreases. The rear areas of the cylinder are sufficiently cooled by contact with the relatively cool face of the rear section of the main piston and by contact with the air rushing after the piston. After the cooling stroke the temperature

on the inside surface will be about that of steam at a low pressure, and it is therefore much lower than it can ever be in any externally cooled engine.

The more heated front parts of the cylinder must not only be cooled superficially; a sufficient quantity of heat must be removed so that the surface temperature cannot exceed a safe level immediately after the cooling action is terminated. On the other hand, not more heat must be abstracted from the body of the metal than what is necessary, so that it cannot take up much of the heat liberated during the next combustion stroke. It will be noticed that in 4-stroke cycle engines the out-going auxiliary piston is followed closely by the main piston on the exhaust stroke. The cooled areas come therefore first in contact with the piston, and in addition the areas adjacent to the clearance space are very soon uncovered and thereby exposed to the cooling action of the fresh charge which may take up any excess heat during the suction and compression strokes. In two-stroke cycle engines the cooling action may be somewhat more intense.

The heat value wasted for cooling purposes is evidently not high, because the action begins after the heat cycle is completed and lasts only about the period of one stroke.

In water-cooled engines the heat loss for cooling purposes is much higher and subject to greater variations. In small engines the heat loss to the water is ordinarily greater than in large engines with necessarily thicker walls, although the latter may run at a lower speed, thereby increasing the time for cooling. For the thermal efficiency, it makes little difference whether the quantity of heat transferred to the water is smaller or larger, because the ratio of the exhaust loss to the total heat generated varies accordingly. Engines having a deficient water-cooling system must work with lower combustion temperatures in order to avoid overheating. The gain in heat due to a smaller loss to the water is thereby again lost owing to the necessity of lower maximum temperatures.

The table below shows the effect on the thermal efficiency and power of an engine resulting from heat losses of variable amount for cooling purposes.

	Heat Value.	Exhaust Loss.	Loss for Cooling.	I H P	Thermal Efficiency.
1	100 parts	35 parts = 35%	10% 40 parts	25 parts	25%
2	120 ,,	35 ,, = 29%	10% = 12 ,,	73 ,,	61%
3	100 ,,	35 ,, = 35%	10% = 10 ,,	55 ,,	55%
4	80 ,,	35 ,, = 44%	10% = 8 ,,	37 ,,	46%
5	70 ,,	35 ,, = 50%	10% = 7 ,,	28 ,,	40%
6	60 ,,	35 ,, = 58%	10% = 6 ,,	19 ,,	32%

Example 1 indicates the heat distribution of a charge of 100 parts of combustible mixture in an average water-cooled engine; the heat due to 35 parts is assumed to be lost in the exhaust, 40 per cent. to the water and 25 per cent. to the piston as power.

In the following examples 2 to 6, the loss for cooling is taken as 10 per cent., the rate estimated for an internally cooled engine; the exhaust loss is assumed to remain constant with the heat due to 35 parts of the combustible charge. It is assumed that the initial volumes of the various combustible charges are constant and that they are more or less concentrated or rich, that the clearance is constant for all charges, and that the expansion stroke is of varying length, so that the pressure at exhaust remains the same for all charges.

In example 2, 120 parts of the original mixture give a power resulting from 73 parts, or a thermal efficiency of 61 per cent. The power is almost three times, and the thermal efficiency more than double that of the water-cooled engine.

In example 3 the original 100 parts give a power resulting from 55 parts, or an efficiency of 55 per cent.

Even if the charge is reduced to as low a value as 60 per cent., the thermal efficiency (32 per cent.) is still 7 per cent. above that of the water-cooled engine.

The above figures show that any economical cooling system affords great possibilities in regard to power and thermal efficiency. They also show that it is preferable to work with low combustion temperatures and to begin with cooling after completion of the heat cycle, even if the latter method involves greater complications.

With the cooling system here described, it is possible to partly recover the heat abstracted for cooling, because steam is generated, whilst in water-cooled engines it is only possible in exceptional cases to make some use of the heat contained in the water. Ordinarily it requires some power and a bulky plant to get rid of this heat.

The system above described is the invention of Mr. J. J. Ruckstuhl, of 10a, High Street, Stockport. In a later issue we shall publish particulars of an "Intermediate Cooling and Scavenging System" by the same gentleman.

INSTITUTE OF MARINE ENGINEERS.

Electrical Distance Thermometers.

AT the Institute of Marine Engineers on Monday, February 20th, a lecture was given by Mr. G. A. H. Binz, on "Electrical Distance Thermometers."

In the course of his lecture Mr. Binz said that increased facilities for the accurate determination of temperatures would, in most cases, prove valuable aids to economy and efficiency, and a demand had arisen for a temperature indicator which could transmit its information over a distance so as to render possible a centralization of all important temperature readings at one point. This was accomplished by the electrical thermometer, by means of which readings could be taken at any desired distance from the source of heat. Small switchboards could be erected at some central point and any desired number of thermometers could be connected to them, and their temperature observed alternately on the same indicator.

The thermometer elements, or the part of the apparatus sensitive to temperature, were entirely of metal, strong, rigid and all but unbreakable. It had long been common knowledge that the resistance which different metals offered to the passage through them of an electrical current, varied with the temperature of the metal body in question, and this fact had been utilised to determine inversely the temperature of such bodies by measuring their electric resistance. Until quite recently, however, platinum was almost exclusively employed for this purpose, and its great cost was naturally a serious obstacle to a wide application of this system of temperature measurement. During the last two years other non-precious metals and alloys had been employed with success for temperatures up to 800° F., the resistance elements being composed of coils of very pure nickel wire. The wire resistance usually took the form of a closely-wound coil, enclosed in a tube of suitable length and provided with a couple of terminals. It was connected to the temperature indicator by means of ordinary copper wire.

To measure the resistance of the elements sensitive to temperature the principle of the Wheatstone Bridge was resorted to. A two-volt accumulator provided all the current required to work the whole system. In order that a number of thermometer elements might be read on one indicator alternately, the galvanometer was mounted on a small marble panel carrying also a series of plug switches. These served to connect the galvanometer with any desired thermometer element and at the same time to place it in circuit with the accumulator.

In reply to questions, the lecturer said the wire used for connections was the ordinary high-tension copper wire, cotton insulated. In bringing the wires through the engine-room from the refrigerating holds, they would not be affected by the heat. As far as he knew there were no installations of the kind he had described fitted on board ship. In a land installation the temperature was recorded from a distance of 1,000 yards. An alarm bell attachment could be fitted so as to give warning of a fire in the bunkers. The apparatus could be applied to take the temperatures of the feed water, and the steam, particularly when superheated, the condensed steam returned and the cooling water, in addition to many other temperatures. In a large refrigerating chamber a number of points could be used, if desired. The approximate cost of an installation of fifty points would be from £90 to £100.

THE INSTITUTION OF CIVIL ENGINEERS. The annual Conversazione of the Institution has been fixed to take place on Thursday, the 29th June, at 8.30 p.m., in the Royal Albert Hall.

EXAMINATION OF ENGINEERS.

THE Board of Trade Circular No. 1501 in Instruction to Examiners and Notice to Candidates, states that on and after January 1st, 1915, the qualifications as regards sea service required from candidates for certificates of competency as Engineer in the Mercantile Marine will be as follows:—

(1.) A Candidate for a second-class Engineer's Certificate will be required, in addition to the apprenticeship described in paragraph 23 (*a*) of the Regulations relating to the Examination of Engineers, or the alternative sea service specified in Circular 1469, to have served eighteen months at sea as Engineer on regular watch on the main engines or boilers of a foreign-going steamer of not less than 66 nominal horse-power; or twenty-seven months in a home-trade steamer of not less than 66 nominal horse-power.

(2). A candidate for a first-class Engineer's Certificate, in addition to the qualifications required from a Candidate for a Second-Class Engineer's certificate, must (*a.*) have served at sea for eighteen months, with a second-class certificate of competency or service on regular watch on the main engines or boilers of a foreign-going steamship of not less than 99 nominal horse-power as senior engineer in charge of the whole watch; or (*b.*) have served at sea for twenty-seven months with a second-class certificate of competency or service as first engineer of a home-trade steamer of not less than 99 nominal horse-power; or three years with a second-class certificate of competency or service as second engineer of a home-trade steamer of not less than 99 nominal horse-power; or (*c.*) have served three years nine months with a second-class certificate of competency or service as third engineer of a home-trade steamer of not less than 99 nominal horse-power, if during the entire period he has been the senior engineer in charge of the whole of a watch on the main engines and boilers; or (*d.*) possess, or be entitled to, a first-class certificate of service.

The service described in paragraphs 38, 39, 40 and 41 of the Regulations may as heretofore be accepted as qualifying for examination in accordance with the conditions specified in those paragraphs.

A candidate for either a Second-Class or a First-Class Certificate, who within two years from the date of application to be examined has attended an approved course comprising general mathematical and scientific instruction at a Technical School recognised by the Board of Trade as suitable for the training of *Marine* Engineers, will be allowed to count time so spent as equivalent to sea service in the ratio of three months at the Technical School to two months at sea. Time so spent cannot be accepted as equivalent to more than one-sixth of the total sea service required for either certificate, but a candidate who has been allowed to count such time on examination for a second-class certificate, will not be debarred from counting similar subsequent time on examination for a first-class certificate.

Time spent in an approved Marine Technical School subsequent to obtaining a first-class certificate and within two years from the date of application to be examined, may also be accepted as forming part of the qualifying service required under paragraph 28 of the Regulations, in the case of candidates for Extra First-Class Engineer's Certificates, but if such time is substituted for sea service, it will only count as equivalent thereto in the ratio of three months at the school to two months at sea.

In every case in which an allowance is made for time spent at a Marine Technical School, the candidate will be required to produce the Principal's Certificate for continuous and regular attendance at all the approved classes and for satisfactory progress.

Messrs. Denny & Co. advise us that they have assumed as partners, as from 1st January, 1911, Mr. George Kerr Ward, Mr. Maurice Edward Denny and Mr. John McAusland Denny, junr.

Record Battleship-Cruiser "Lion."—The publisher has a few photogravure prints of this superb vessel at the following rates. Plain prints, 1/- each; india proofs, signed by artist, 2/-, printed surface 9 in. by 6 in., size of mount, 15½ in. by 11½ in.; framed prints, 2/- extra.

H.M.S. "THUNDERER."

ON February 1st, at the shipyard of the Thames Ironworks Shipbuilding and Engineering Co., Ltd., the launch of H.M.S. *Thunderer* took place without a hitch of any sort and with due and proper ceremony. The occasion is a triumph for the builders and their chairman, Mr. A. F. Hills, and shows what can be done in the face of adverse circumstances if there are only the man and the will behind. The keel plate was laid, as we know, as recently as the 13th of last April, and here is the vessel being built and taking the water in the brief period that has elapsed since. Who shall say this is not a creditable performance, worthy of the company which has accomplished the task and undoubtedly making credit as well as profit for the district? The launching weight was about 9,600 tons, there being, of course, no armour or equipment of any kind, but merely the hull. The Admiralty party present at the ceremony was a large one and included Mr. M'Kenna (First Lord of the Admiralty), Dr. Macnamara (the Parliamentary Secretary) and Admiral Briggs (the Controller of the Navy). The Lord Mayor attended in State and neighbouring Mayors were also invited. After the launch a large number of the guests repaired to a specially-erected marquee where tea was served. Mr. Hills thanked them for their presence there and also Mrs. Randall Davidson for her good offices that day. Mr. Hills then proposed the toast of "Good Luck to the *Thunderer*," which was replied to by the Archbishop of Canterbury. The toast of "Continued Prosperity to Old Father Thames," proposed by the Lord Mayor, was well received.

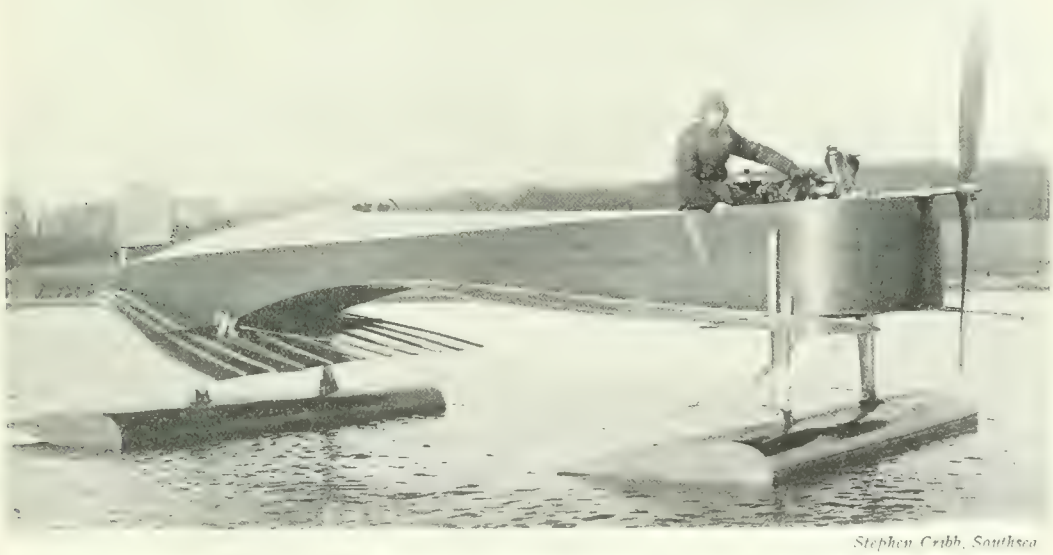
We trust that with the success so far attained this will not be the last vessel of her class to be built at the Thames yard.

The first "Dreadnought" to be built on the Thames being safely in the water, she was taken in charge of tugs and towed to her fitting-out berth at Dagenham, where she will be completed. Here her machinery and heavy guns will be lifted on board by the 150-ton crane which has been specially built for the purpose. This crane, like the vessel, is the largest and most powerful erected on the river Thames. The berth at Dagenham became necessary on account of the width of the present type of battleship having exceeded the breadth of entrance of the various wet docks in and about the Port of London, and the Directors of the Thames Ironworks, in order to be fully eligible for the largest of Admiralty work, provided this up-to-date berth. A ferro-concrete jetty, constructed on the latest of principles, stretches from the shore into the river for a length of 352 feet, with a breadth of 22 feet and terminates at the river end in a T-head 146 feet long, alongside which the *Thunderer* is moored in a depth of 30 feet of water at low tide.

The *Thunderer* is a super-"Dreadnought" and is a sister ship to the *Orion*, *Monarch* and *Conqueror*. Her general dimensions are, length overall 584 feet, beam 88½ feet, mean draught 27½ feet, displacement 22,680 tons and her designed speed is to be 21 knots. The turbine machinery, of 27,000 I.H.P., is being constructed at the builders' engine works at Greenwich and is well advanced towards completion. The armament is to be ten 13·5-in. and twenty-four 4-in. guns, with three 21-in. torpedo tubes.

THE RAVAUD AERO-HYDROPLANE.

WE are able to present to our readers illustrations of the aero-hydroplane which has been invented by the aviator, Mr. Roger Ravaud, and has been built by Mr. Samuel Saunders at East Cowes Works. The illustrations clearly indicate that the machine comprises two hydroplane floats, one at the forward end of the boat and the other at the after end, and which are pivotally attached to the supports carried by the body of the machine. These floats are each about twenty feet in length, and enable one to appreciate the size of the machine as a whole. The body of the machine is a structure not unlike a boat, and is provided with a 50-h.p. Gnome petrol engine, which drives the aerial propeller disposed at the rear end of the machine. The direction of the machine in a horizontal plane is effected by means of an aerial rudder disposed over the bows, and is controlled by the steering wheel situated immediately in front of the driver's seat. On each side of the boat, and running from amidships to the stern, is disposed an aeroplane, by which the vertical stability of the machine is ensured; while a third plane of triangular shape is arranged vertically under the bows and extends rearwardly to midships, the purpose of which is similar to the two after planes. We understand that three or four passengers can be accommodated in the body in addition to the driver. The machine, after it has been thoroughly tested on the Solent, is to be sent out to the Mediterranean in order to take part in the Monaco races, provided, of course, it fulfils in every way the expectations of the designer.



Stephen Cribb, Southsea

Mons. Roger Ravaud at the stern of his Aero-Hydroplane at Cowes.

MESSRS. MATTHEW KEENAN & CO., LTD., have been successful in obtaining a large number of orders recently, including H.M.S. *Falmouth*, now being built by Messrs. Beardmore and Co., Ltd., and they have enough work now to keep them busy for many months to come. They have lately brought out a new catalogue, which is most interesting to steam and refrigerating engineers and well worth filing for reference. Messrs. Matthew Keenan & Co., Ltd., now have works in both London and Glasgow.

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

The Sale of an Old Greyhound.

THE Turkish Government is contemplating, or has, indeed, perhaps commenced, a considerable movement of troops to Arabia. For this purpose it is anxious to obtain a number of vessels suitable for use as transports, and to secure them has sent a commission to Western Europe. Visiting in the first place Germany, it bought four Nord Deutscher Lloyd steamers. These were the—

	Year built.	Builders.	Place of Build.	Gross tonnage.
Darmstadt ..	1890	Fairfield Co.	Glasgow	5012
Oldenburg ..	1890	Fairfield Co.	Glasgow	5006
Roland	1893	Armstrong's	Newcastle	3003
Heidelberg ..	1893	Reiherstieg Co.	Hamburg	3372

all four being single-screw steel vessels. The third of the quartette was especially suitable for the purpose in view, having been specially designed by her owners for the steerage traffic across the Atlantic. Then proceeding to England, the Commission went to Liverpool and found in the Wallasey Dock the steamship *Ottawa*, of the British and North Atlantic Steam Navigation Co., and added her to the list. The *Ottawa* is an iron screw steamship of 5071 tons gross register, built as long ago as the year 1874 at Belfast by Messrs. Harland & Wolff. Her last service was with the Dominion Line in their St. Lawrence service, for which trade she took her present name. But she was originally the White Star Liner *Germanic*, which, in the middle seventies —before Mr. Guion brought out his *Arizona*, *Alaska* and *Oregon*—contended with her sister the *Britannic* and the Inman liner *City of Berlin* for the Atlantic record. Each of the three vessels named, being contemporaries, achieved the first distinction in turn. Her engines were originally the four-cylinder tandem compounds, which in those early days were the standard type of her builders—but at that time Queen's Island did not construct machinery itself and the engines of the *Germanic* were in fact built by Messrs. Maudsley's, Sons & Field, of London. But in 1895 the vessel underwent a complete overhaul at a cost, it has been said, of no less than six-tenths of her original price. New engines—this time of the triple-expansion type—and new boilers were provided, and her accommodation almost entirely re-designed and renewed. She became a favourite ship again in the New York trade, and maintained a wonderful show of speed, the log of her 264th trip across the Atlantic being most noteworthy. In 1899 she sustained a remarkable misfortune, being sunk at the White Star Wharf at New York by the

accumulations of ice on her upper works in a blizzard. This disaster involved a further renewal of her accommodation. In October, 1903, she left the New York service of the White Star Line, but was used during the summer of the following year in the Southampton service of the American Line. In January, 1905, she was taken over by the Dominion Line—yet another branch of the Combine—and employed in the St. Lawrence service until the advent of the big steamers *Laurentic* and *Megantic* rendered her further activity in that direction unnecessary, and she then took her place in the Wallasey Dock.

The Cunard Company

sent the first of their three new steamers to sea on the 25th of February, the 18,000-ton *Franconia* taking the westward mail of that date. This leaves two vessels, the *Laconia*, a sister to the *Franconia*, and the giant 50,000-ton turbine-engined vessel, under construction. During the month the announcement of the name to be allotted to the new monster has been announced. She is to be called *Acquitania*, that being the ancient Latin title of one of the most famous provinces of France, and a name peculiarly fitted for a Liverpool ship, since, as has been recently pointed out by Sir William Forwood in his most interesting book of reminiscences, the first charter of the town of Liverpool, granted by King John—a monarch who is less kindly thought of elsewhere than on the banks of the Mersey—was signed by that unfortunate monarch as King of England and amongst many other distinctions, Duke of Acquitaine. As Sir William Forwood is doyen of the directors of the premier Atlantic company, it may well be that he put forward the name at the Board for the reason he has elsewhere given.

The South-Eastern and Chatham Railway,

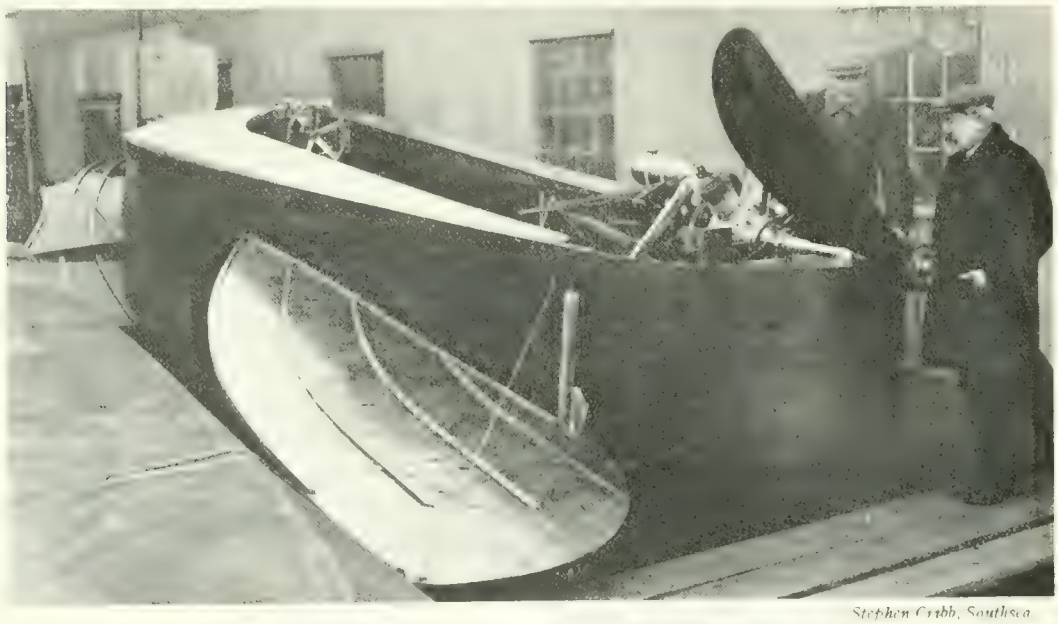
already the possessor of five turbine-engined passenger steamers—is credited with the intention to add a couple more such vessels to its fleet. Though but a short while ago the fleets of the two constituent Companies contained nothing but paddlers, the Board some time ago disposed of the last vessels of that class, save the three sisters *Dover*, *Calais* and *Lord Warden*, built for the Dover service of the Chatham Company by Messrs. Denny, of Dumbarton, in 1896. This trio, however, is already marked out for removal from the fleet, as one of them, the *Lord Warden*, has been sold during the month of February.

The North Sea services of the South-Eastern & Chatham and of the Great Eastern Railway Company are both to be considerably accelerated. The journey to Hamburg, Cologne, and Berlin—with, of course, the various cities to which access is obtained by route passing through these centres—will be shortened from one hour to upwards of two hours, commencing about May the 1st. The Great Eastern Company will not alter its route or its time of departure from London. But it will deliver its passengers at Hamburg at 2.47 p.m. instead of as heretofore at 5.4 p.m., thus effecting the transit in eighteen hours and seventeen minutes. The Berlin arrival will be made at 5.20 p.m., instead of 6.51 p.m., so that here there will be a shortening of the journey to the Prussian Capital by an hour-and-a-half.

The South-Eastern & Chatham are, however, to obtain similar reductions in time of transit by their night service by a change of port. The night mail steamers of the Flushing line will in future desert Queenborough for Folkestone. This will shorten the sea-passage by over an hour and so enable the railway connections on the other side to be duly made. Queenborough will, however, be retained as the English port for the day service of the Flushing Company. From the statement as yet published it would appear that the hours of departure—hitherto in force for both the Harwich and Flushing steamers—8.30 p.m. from Liverpool Street in the one case, and 8.35 p.m. from Victoria in the other—will not be interfered with.

The P. & O. Company,

having one of its new "M." steamships in the water and the other practically ready for launching, has, it is stated, placed orders with Messrs. Caird & Co., of Greenock, for a couple more of the "Nile" class of liners. These are twin-screw vessels of about 8,000 tons gross register and chiefly employed in the service from Middlesbrough, Antwerp and London to the Straits Settlements, Hong Kong, Shanghai and Japan.



Stephen Cribb, Southsea.

Mr. Ka and 'Flea,' fitted with a 50 H.P. Gnome Engine.

The Houlder Line

has increased its fleet by the purchase of two important vessels. One of them, the *Irak*, hitherto owned by Messrs. J. H. Welsford & Co., of Liverpool, is a twin-screw liner of upwards of 8,000 tons gross register. She was built in 1902 at Belfast by Messrs. Workman, Clark & Co. She is to be known in her new employment as the *Leven Grange*. The other purchase is smaller, being of under 7,000 tons and a single-screw. She was built at Newcastle in 1907 by Messrs. Palmer, and was formerly known as the *Guardiana*, but on joining the Houlder Line she will take the name of *Sutherland Grange*.

The Union Company of New Zealand

has taken an unprecedented step in ordering a steamship from a Belgian firm. Their *Ihumata*—a vessel of some 230 ft. long by 35 ft. 6 in. beam—was launched by The Antwerp Shipbuilding Company on the 24th January. She will not, however, be of entirely foreign construction,

as her machinery is to be made by The North-Eastern Marine Engineering Co., of Wallsend-on-Tyne.

Disasters.

The Shaw Savill & Albion Company's steamship *Aotea* went ashore at Mouille Point, Table Bay, on the 21st January. There was fortunately no loss of life. But there was a great scare the next day amongst the local people when it was discovered that fire had broken out in the stranded steamship, for it was known that her cargo had comprised some 350 tons of dynamite, and the worst was feared by the inhabitants. Fortunately they were disappointed of an explosion, and this for two reasons. First the fire was confined to the engineers' quarters and did no damage elsewhere, and secondly, the landing of the dangerous goods had been completed ere ever the fire broke out. At first it was considered that the condition of the steamer was hopeless. But later accounts tended to make underwriters and salvors more hopeful every day. This single-screw steamship was built in 1895 at Newcastle by Messrs. C. S. Swan & Hunter. She has recently been unlucky—having been ashore in June of last year at Martin River in the St. Lawrence. The present casualty, however, seems to have been due to no carelessness in navigation as it seems to have been proved that on the night of the stranding the light on the breakwater was misleading.

The Union Castle Company

has, I think, chosen names never before used in its fleet for the three steamships which are building for it by Messrs. Harland & Wolff and Messrs. Barclay, Curle & Co. They are to be called respectively *Guildford Castle, Gloucester Castle* and *Galway Castle.* As the old "G.'s" of the Union Line therefore are, as time goes on, found too small for modern requirements, there will be coming on a new series of "G" *Castles* to perpetuate the old idea.

The Montauk Point Scheme

really looks—if we may believe reports from America—as though it might come to fruition. For it is reported that the Long Island Rail Road has purchased an estate of 160 acres at Montauk Point, where it proposes to build 1,000 ft. piers for the accommodation of the big liners which will so soon be introduced into the trade.

Compulsory Wireless.

Canada would seem to be about to follow the examples of the United States, Austria and Italy in making wireless telegraphy compulsory for passenger vessels carrying fifty passengers or more on voyages of 200 miles or upwards, as a Government Bill to this effect has been introduced into the legislature.

The West India Mails.

Early in January it was announced that a new contract for the carriage of the West India Mails had been secured by the Royal Mail Steam Packet Company, and that the first sailing under the new arrangement would be made by a departure from Southampton on the 18th January. The consideration to be received by the contractors was to be a payment of £63,000 per annum, whereof no less than £20,000 was to be contributed by the island of Trinidad, which, in return for so statesman-like a contribution, was to be made the headquarters of the service, the main line vessels proceeding thither direct from England. So far so good. Trinidad hoped and expected that by this payment it would secure for itself the trade which hitherto had centred at Barbados. I cannot quite therefore understand the inwardness of the further arrangement which at the beginning of February seems—according to the statement of the West India Committee—to have been grafted on to the original contract. We are told now that Barbados is to pay a sum of £4,000 a year and is, after all, to have a call from the mail steamers before they reach Trinidad. At the first blush it would look as though this was a kind of breach of faith with the Trinidad people, who would lose what they had paid so heavily for. But on consideration one sees another possibiity. Barbados may still have the call, and yet lose its importance as a distributing centre, if as I take it to be the case, Trinidad is henceforth to be the distributing centre from which the inter-colonial services will radiate.

Messrs. Elders & Fyffe have secured a contract for the conveyance of the Jamaica mail in place of that banana subsidy which the Imperial Direct Company held between Bristol and Kingstown, whilst the Elder Dempster Company announces that it is about to institute a new direct service between New York and the various ports of West Africa.

AN OIL-ENGINED 7,000-TON LINER.

THERE is at present building at Glasgow a large steamer to be engined by oil-driven motors. The tonnage of this new liner will be 7,000 tons deadweight and about 5,000 tons gross. The well-known firm of engineers in Copenhagen, Messrs. Burmeister and Wain, are associating themselves with the Clyde builders, Messrs. Barclay, Curle & Co., Whiteinch, in the enterprise of sending forth the first ocean cargo and passenger steamer equipped with internal combustion oil engines. Messrs. Burmeister & Wain have done much in recent years in developing the Diesel engine, and have supplied some of the largest oil engines of this type to Continental buyers.

While the hull of the new liner is being built at Whiteinch the engines are under construction at the Stobcross engine works, belonging also to Messrs. Barclay, Curle & Co. There are to be two sets of combustion-cylinder engines of the Diesel type, with improvements which have overcome the early troubles met with in starting and reversing the engines and other minor details. A smaller Diesel engine will be installed to generate electric power to drive the steering gear, winches and windlass, and also to supply all the lighting equipment on board the steamer. Copenhagen experts are co-operating with the Stobcross engineering staff, and though the vessel is not for British owners, yet the Clyde firm hopes that the trial trips and early voyages will induce the home shipowners, especially the Atlantic firms, to give orders for motor liners.

In the improved Diesel engine there is no magneto or spark required to ignite the charge, this being done by compression. A great advantage of the oil motor is the shortening of time occupied in getting ready to start. The engineer of this new steamer will be able to start the engines in five minutes, as compared with fifteen hours to raise steam with boilers. There will be twin screws fitted, and as no great speed is desired—for although a certain number of passengers will be carried, yet cargo is the principal object of the vessel—the average speed of twelve knots will be given.

In designing the engines the aim has been to permit of the cheapest quality of oil to be used, whether Scottish shale oil or American petroleum, and the price at present of the low-grade oils is quoted at under 40s. per ton. The tank storage on board will only be about a fourth of the space that would be reserved for coal bunkers. The estimate is made that 100 tons of oil will take the liner as far as 300 tons of coal driving ordinary steam engines. In appearance the new steamer will present an unusual spectacle, as she will have no funnels, and to the engineers the absence of boilers and bunkers will have all the charm of novelty. It is anticipated by Messrs. Barclay, Curle & Co. that the Atlantic service will soon include passenger motor liners, as the absence of smoke and dirt and ashes on the voyage between the United Kingdom and the States or Canada will appeal to passengers.

The first British Diesel engine was made in Glasgow by the Mirrlees Watson Company nearly fourteen years ago; but great improvements have been effected on the oil engine since then and working is much simplified. In 1908 the Diesel engine business of the

Mirrlees Watson Company was transferred to Stockport. In their power-house at Stockport they have a two-cylinder Diesel engine of 250 b.h.p. installed. It has been running daily since it was set up in April, 1910, and the air and exhaust valves were only withdrawn and cleaned for the first time in November, after running about seven and a-half months, while up to January last the valves on the air compressor had not been removed, nor had the cylinder covers or pistons.

Messrs. Yarrow & Company, of Scotstoun, Glasgow, have in hand a triple-screw oil-engined boat, and also a twin-screw motor, both of fair size.

But the first oil-engined steamer to cross the Atlantic will be the *Toiler*, built at Wallsend-on-Tyne by Messrs. Swan, Hunter & Wigham Richardson, Ltd. She will leave as early as possible for Montreal. Her deadweight capacity is 3,000 tons, or about 97,000 bushels of grain, and she is for service on the Canadian canals. The engines are a modification of the Diesel type, and consist of two sets driving twin screws. They are directly connected without clutches to the propeller shafts. The starting and reversing gears are operated by compressed air. The fuel is crude petroleum of the cheapest quality, and is injected into the cylinder without being vaporized, and ignited and burned in a charge of hot air.

OIL-ENGINED VESSELS.

THE trials of the *Vulcanus* (Messrs. The Anglo-Saxon Oil Co.), the launch of the *Holzapfel I.* (Messrs. Holzapfel), and the placing of the order for a large cargo-vessel with Messrs. Barclay, Curle & Co. to be fitted with oil engines in association with a Danish firm, whose extended experience in this class of engine bids fair to crown the venture with success, have brought vividly before us the advances being made by the explosive engine in competition with the steam engine for larger types of vessels, as it has been for the smaller types during recent years, and steadily gaining in favour. The new launch for Messrs. Smith's Dry Dock Co., at Middlesbrough, fitted with reversible crude-oil engines of about 40 B.H.P., further accentuates the position by bringing the use of this class of machinery directly under the observation of the firm's customers on the Tees. The *Toiler*, by Messrs. Swan & Hunter, Newcastle, for Canadian owners, is another added to the list. The veiled reference made in our February issue may now be stated as due to the order recently given by the Marquis of Graham for a yacht about 80 ft. long to be fitted with reversible oil engines of about 100 B.H.P. This vessel promises to be a very fine example of her class, according to the design of Messrs. Beardmore, both in respect to accommodation and fittings. The development of the gas engine, whether the base of the fuel be oil or coal, has been due to a greater extent to Continental than British firms, and the reproach cast upon the latter bids fair to be removed soon. The advantages of the crude-oil engine for small craft, canal and other barges, are undoubted, and have been recognised for several years where canal traffic is extensive, and to this have been largely due the development and improvements which have sprung from experience. The intense interest taken by marine engineers in the progress of the explosive engine and the papers which have been read on the subject have tended to familiarise the rising generation of engineers with the points for discussion and the details of the machinery, and where these differ from the more familiar steam drive. The magnetic and the electric transmission gear have also been discussed, and the launch of the *Electric Arc* on the waters of the Clyde, to be fitted by Messrs. Mavor & Coulson, Glasgow, will be a good object lesson in connection with the electric gear. A good counter for the explosive engine is a desirable instrument in the outfit, and Messrs. Schäffer & Budenberg are the makers of one, the Graham twin-gas-engine counter, which is claimed to be reliable and good. One counter indicates the number of compressions, the other indicates the explosions, thus recording the number of revolutions. There are many enquiries in the market for small craft to be fitted with explosive engines, and the question of auxiliary power for warping, hoisting and the usual deck machinery is one which is much discussed. The electric winch, windlass, and steering gear, do not appeal to the average enquirer as quite desirable ; the element of cost is a consideration of no mean moment, and the adoption of compressed air has been weighed in the balance. The Exhibition now advancing, in regard to proposed arrangement, promises to be an excellent medium for showing under test the various types of deck machinery as well as of the prime movers, and we look forward to seeing a good selection of such, when the Exhibition is opened on the north-east coast.

It may here be noted that the London County Council has ordered a direct reversing Diesel engine of 100 B.H.P. for departmental work on the river. This, with the new launch for the Missions to Seamen, fitted with Beardmore oil engine of 75 B.H.P., will give two interesting vessels to the Thames. The discussion on auxiliary-powered vessels has been favourable to the minds of many owners and prospective owners, and the yacht *Phantome* is now being installed with heavy oil engines by Messrs. Bragil, Straker & Co., Bristol, the set being among the largest made by this firm. The yacht is in the hands of Messrs. Camper & Nicholson, Gosport, and there are several points in the details which, among those who know the work of this firm, lend additional interest to the outfitting. Other auxiliary-powered vessels are the Trinity House pilot cutters on the Harwich and Isle of Wight stations. These have, from what we can gather, proved both convenient and handy boats for their purpose, and may lead to further extension round the coasts. The wakening up of builders and owners and the impetus given to the gas-engined vessel and its possibilities in many directions of traffic have shown that the makers in this country were but awaiting their opportunity to meet the market, indeed many have been competing favourably with Continental makers, a fact which ought to be generally known, as many orders have been placed on the Continent which might have been equally well executed in Britain by means of enterprise and fuller enquiry. Possibly the area of enquiry has been too narrow and well-known Continental makers have been kept in closer touch with the market. Should this be so, opportunities should be taken advantage of to reverse the policy.

INSTITUTE OF MARINE ENGINEERS (INCORPORATED).

Marine Boiler Repairs.

AT the Institute of Marine Engineers on Monday, February 6th, a paper was read by Mr. James Innes (Member) on "Marine Boiler Repairs." Mr. John McLaren (Member of Council) presided.

In the course of a very full treatment of the subject, the author described numerous cases of boiler troubles and the best methods to be adopted in remedying them, a few of which might be mentioned.

Boiler Shells. In cases where the end plates are flanged outwards for the purpose of hydraulic riveting to the shell, it is not uncommon to find considerable corrosion through leaky rivets. At an early stage this defect can be overcome if the rivets are cut out and the holes countersunk on both sides and re-riveted. Where this is not done and the seam is neglected, the shell and end plates will require patching, a most difficult and unsatisfactory job.

End Plates. Front plates in the steam space are sometimes found considerably corroded at and above the normal water line. This action can be stopped by making a clear air space between the uptake and the front top plate, and where such space exists by keeping it clean. When, however, the corrosion has gone so far that it is necessary to deal with it, riveted washers should be fitted to each stay outside, or a continuous doubling plate or strip riveted on outside, taking all the stays. In cases of grooving and cracking of the furnace front plate flange to which the furnace is riveted, the front plate may be renewed, which means a renewal of the furnaces, or a repair may be effected by cutting out the rivets in way of the crack in the furnace connection

to flange, and if the front plate is fitted on the inside of the front tube plate, to cut out the rivets connecting them together for a distance equal to the length of the proposed patch. The crack should then be studded at each end, a flanged angle plate about ½ in. thick should be carefully fitted and bedded close on the inside, taking in the seam of the tube plate and furnace rivets, also a number of tack rivets through same here and there. After the angle patch has been riveted and caulked, it should be forced with red lead by means of a pump.

FURNACES. Corrosion along the firebar line is more a question of treatment than of design or circulation. To avoid corrosion, if this part is kept well scaled and cleaned, and the water kept as free from acid as possible, it will not exist. In cases where it does exist soda should be used, and zinc plates should be hung on studs where the corrosion is worst, not intermittently, as is so often done, but continuously until the corrosion is removed. The cracking of furnaces is in every case due to the accumulation of scale. To

The late Mr. Duncan Robertson.

repair a crack, it is usual, in the case of a corrugated furnace, to lock-stud it. This method of repair is at best only a temporary one, as it is necessary to renew the studs very often. When local distortion or a bulge forms on the furnace, it is almost better not to interfere with it other than to keep it clean. Girders are sometimes fitted with a bolt through the bottom of the bulge, but usually this only makes the bulge worse than before.

TUBE PLATES. When a tube plate cracks between two tubes in the nest of tubes, the plate should be cut through and a piece dovetailed in and clenched over on each side; the tube holes should then be filed out, and two new tubes (stay tubes for preference) fitted. The crack should not be "lock-studded," nor should a spectacle plate be fitted on the fire side.

Other points treated by the author were combustion chambers, stays and boiler accidents generally.

In opening the short discussion which followed, Mr. H. Ruck-Keene remarked that repairs to end plates, where grooving or cracking occurred, were effectively carried out by the oxy-acetylene process of welding. He supported the author's statement with regard to the damage caused by chipping and caulking leaky seams in the combustion chamber. Mr. J. T. Milton emphasized the fact that most of the breakdowns enumerated by the author could be avoided by keeping the boilers clean. With regard to the screw stays he thought it more generally the case that the stays were wrongly made than that the taps were incorrect. Among other points he mentioned that all nuts exposed to the fire should be solid and not welded. Mr. W. Walker remarked upon the inefficiency of filters generally in keeping oil out of the boilers, and the danger of badly fitting manhole doors. He mentioned a case where a repair along the line of the fire-bars had been repaired very satisfactorily by means of the oxy-acetylene process. Mr. Innes briefly replied to the points raised, after which the discussion was adjourned. The meeting concluded with a hearty vote of thanks to Mr. Innes.

OBITUARY.

DUNCAN ROBERTSON.

BY the death of Mr. Duncan Robertson, chief surveyor in Scotland for the Bureau Veritas Register of Shipping, Glasgow and the Clyde have lost one who for the greater part of his lifetime was closely associated with Clyde shipbuilding and shipping, and who was very widely known and respected in all the shipbuilding and engineering establishments of the district. His demise, in his seventy-second year, occurred somewhat suddenly on February 7th, at his residence, Baldroma, Ibrox, Glasgow. Mr. Robertson was a native of Greenock, where he was born in 1839, and was the eldest son of Mr. John Robertson, of Messrs. John Robertson and Co., at one time shipbuilders at that port. He was educated at Greenock Academy and the Highlanders' Academy, and served his apprenticeship to shipbuilding in the yard of Messrs. Caird & Co. When his father started business as a shipbuilder, young Mr. Robertson became manager of the yard. Following upon the closing of the establishment about 1869, and a short period of association with several other Clyde yards, he received the appointment of surveyor to the Liverpool Underwriters Registry, first at Liverpool, afterwards at Hull and Sunderland, and latterly as chief surveyor in the Clyde district. When the Liverpool Registry was absorbed by Lloyd's Register in 1885, Mr. Robertson became manager of the London and Glasgow Shipbuilding Company's yard at Govan, where he remained until he joined the Bureau Veritas, in 1890, as chief surveyor for Scotland, with headquarters in Glasgow. In the earlier part of his professional career he practised as a consulting naval architect, and was responsible for the design and construction of a number of vessels, notable amongst which were the *Kintyre* (built under his own snpervision in his father's yard at Greenock), the *Kinloch* and other screw steamers of the Campbeltown Steam Packet Company. He was a member of the Institution of Naval Architects, of the Institution of Engineers and Shipbuilders in Scotland and of L'Association Technique Maritime, Paris.

INSTITUTE OF MARINE ENGINEERS.—Owing to the lengthened absence of Mr. Reddaway in Russia, the presentation to be made to him of the gold emblem of New Zealand by Sir Wm. Hall Jones, the High Commissioner, has been postponed till April.

REFRIGERATING APPARATUS FOR MARINE TRANSPORT.

(Continued from page 261)

Forms of Refrigerating Apparatus.

As mentioned before, the office of the refrigerating apparatus employed is to transport the heat that is in the produce in the cold chamber, and that leaks through the walls, floor and roof of the chamber to the water in which the ship is floating. The *modus operandi* varies, but all are on the following lines. One of three or four substances which lend themselves readily to alternate liquefaction and gasification is alternately liquefied by the apparatus to be described, and allowed to assume the gaseous condition. As marine engineers know, nearly all substances may assume the gaseous, the liquid or the solid condition, according to the quantity of heat delivered to them, and usually according to the pressure to which they are subject. Water is the readiest and most instructive example of the ability of any substance to assume the three conditions. Water, when a sufficient quantity of heat is delivered to it, assumes the form of steam. On the other hand, if water is deprived of a certain quantity of heat, it assumes the form of ice. Similarly ammonia, carbonic acid and sulphurous acid, the three substances most commonly employed, will, if allowed to expand, and if they can obtain necessary heat from surrounding objects, pass from the liquid to the gaseous condition. If, after having expanded to the gaseous condition, they are compressed and are deprived of the latent heat of gasification, they will again assume the liquid state.

There are two forms of apparatus in which ammonia is alternately liquefied and made to assume the gaseous condition, *viz.*, what is termed the "Absorption System," and what is known as the "Compression System." Carbonic acid and sulphurous acid are only employed with the compression system. Ether also is employed to a small extent with the compression system, principally in India.

The Compression System.

The compression system is the one most commonly employed in the large number of refrigerating plant in use in different parts of the world, but the absorption system, which was earliest on the market, but which has been displaced up till very recently by the compression system, is gradually coming to the front again.

In the compression system, as its name implies, the important part of the apparatus is a compressor. It is really a gas pump. It is sometimes single acting, and sometimes double acting. It consists of a metal cylinder, very similar to a steam cylinder, with a piston travelling to and fro inside. There are also suction and delivery valves. On one stroke of the single-acting compressor, gas is drawn into the cylinder, and on the return stroke it is compressed to a certain figure, depending, as will be explained later, upon the temperature of the cooling water, and upon the substance itself. With double-acting compressors, gas is drawn into the cylinder at each stroke, and is compressed at each stroke. That is to say, gas is drawn into the cylinder on one side of the piston at each stroke, the gas which was drawn in on the opposite side of the piston being compressed during that stroke, and the gas which is now drawn in being compressed on the return stroke. In the compression system, in addition to the compressor, there is a condenser, usually a receiver, and an evaporator. The whole system forms a closed circuit, just like an electric circuit, but with the important difference that the circuit is never opened. It is of the utmost importance that air should not leak into the system, and that the refrigerant, ammonia, carbonic acid or sulphurous acid, should not leak out. The troubles that are met with in handling refrigerating plant are due in a great many instances to leaky joints or leaky glands. Fig. 4 is a diagram showing the arrangement of the compression system.

The Condenser.

The condenser is very similar in arrangement to the surface condenser with which marine engineers will be familiar. In a favourite form, there is a tank, which may be cylindrical or which may have any other form that is convenient, and a coil of pipe is placed in the tank. The tank is filled with cooling water, kept constantly in circulation by the aid of a pump in the usual way, and the gas which has been compressed in the compressor cylinder passes through the pipes, and is cooled to the liquid condition. In Figs. 5 and 6 two forms of the usual submerged condenser are shown. In these, it will be observed, agitators are employed to distribute the cooling effect. On shore, another form of condenser is gradually coming into use more and more, and there may be cases on

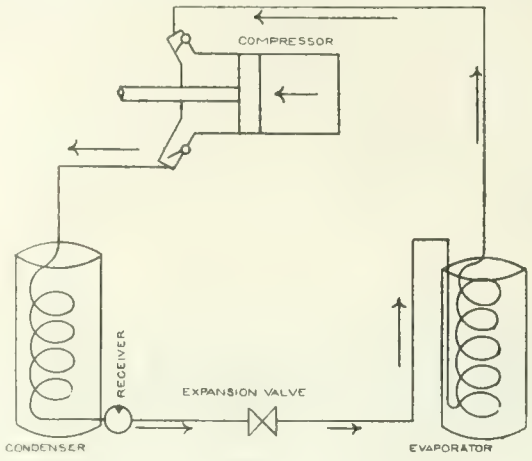


Fig. 4

board ship in which it could be employed. It is termed the "Evaporative" condenser, from the fact that it operates through the evaporation of a certain amount of the cooling water, in place of entirely through direct conduction of heat from the condenser pipes to the circulating water. In the

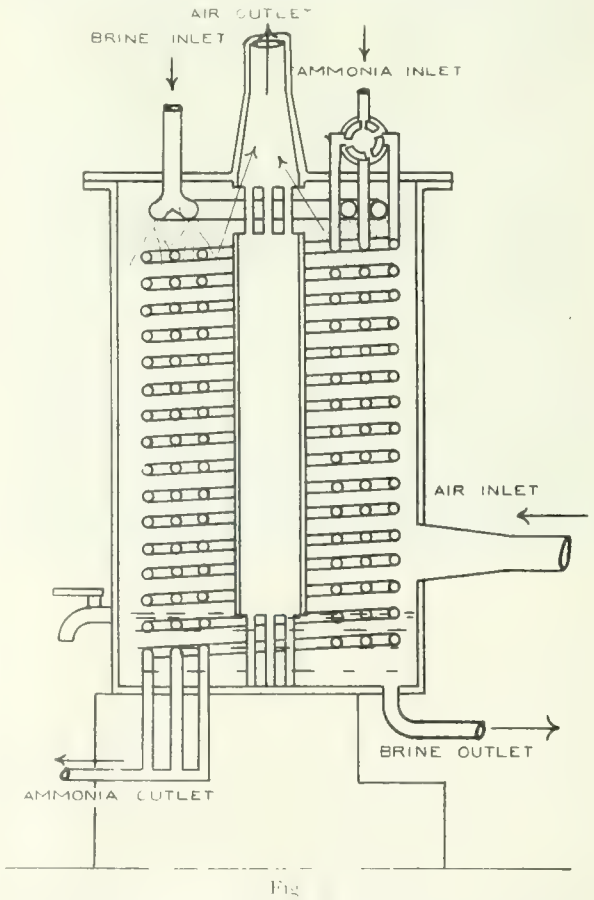


Fig.

evaporative condenser there is a grid of pipes, fixed in any convenient position. On shore, they are fixed on the side of a building, or on the top of a building as favourite positions. There is a trough below the lowest pipe of the grid, and one or more perforated pipes above the upper pipe of the grid.

The cooling water is pumped into the perforated pipe, and passes out through the perforations, in fine drops, which trickle down over the surfaces of the pipes in the grid. Where it is possible, the surfaces of the pipes are exposed to a current of air. The cooling of the gas to the liquid condition is effected by the direct conductive action, the direct conduction of heat from the pipes to the water passing over them, and by the evaporation of a small portion of the cooling water, the latter being by far the more important operation of the two. The cooling water falls into the trough below the grid, and is pumped up again to the perforated pipe above the grid, the waste due to evaporation being made good from a reservoir. In the case of board ship work, where sea water is used for cooling purposes, the great difficulty in connection with the use of an evaporative condenser would be the deposit of salt upon the surfaces of the condenser pipes. Salt, especially in the finely divided state in which it is deposited under such conditions, offers a considerable resistance to the passage of heat through it, and hence unless the pipes are kept clean, the efficiency of the condenser would quickly deteriorate. On the other hand, where there is a good system of ventilation, and particularly where a hot engine-room is ventilated by the aid of fans, if an evaporative condenser could be placed in the path of the exhaust air, it would

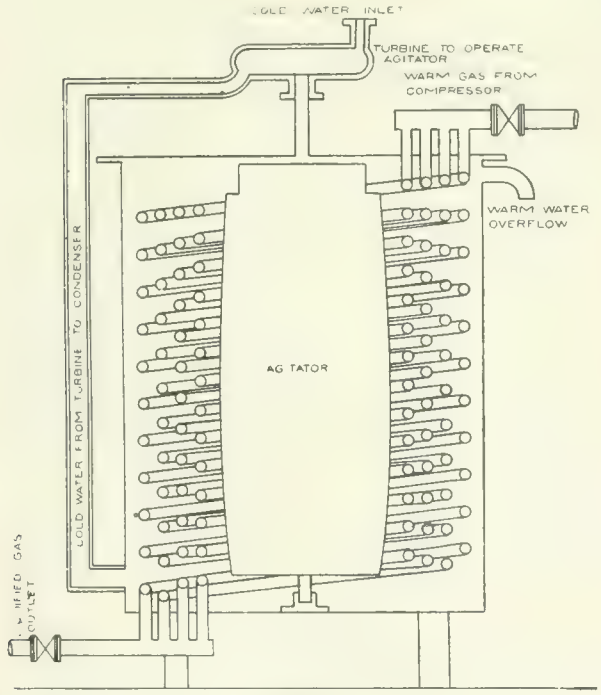


Fig.

probably be very efficient. The cooling effect of the condenser depends directly upon the quantity of water that is evaporated in any given time, and this again depends upon the temperature of the air passing over the condenser pipes, and upon the percentage to which the air is saturated with moisture. The capacity of air for absorbing moisture increases very rapidly, especially at comparatively high temperatures, such as would rule with air coming from the engine-room. The use of an evaporative condenser, therefore, may be worth considering.

When there is a receiver the condensed liquid passes from the condenser into it. The receiver is merely a cylinder arranged to hold the condenser liquid, and with a gauge on its front showing the quantity of liquid present.

[To be continued.]

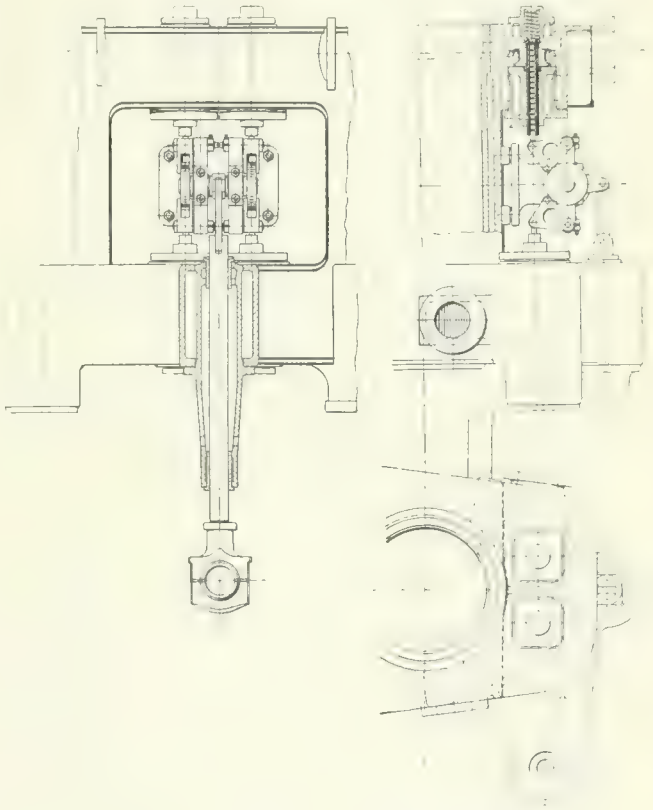
THE COLD STORAGE AND ICE ASSOCIATION.—At the Royal Society of Arts, John Street, Adelphi, W.C., on the 28th February, a paper on a subject intimately connected with many of the problems of the industry—"Thermometry in its application to the carriage and storage of refrigerated produce"—was read by Mr. Fredk. Simpson, C.E., A.M.I.C.E.

MARINE STEAM ENGINE VALVE GEAR.

(FROM A CORRESPONDENT.)

THE three usual prime movers for the propulsion of ships are the steam engine, the steam turbine and the internal combustion engine. Of these the latter has been successfully employed for smaller vessels. As soon, however, as great safety of working becomes necessary, as in the case of vessels for long voyages, the steam engine, with its large store of power in the boilers, its lower pressure in the engine, the comparatively simple valve gear, will, so far as absolute reliability is concerned, take a front rank.

Some few years ago, when the steam turbine first entered the field as a serious competitor to the piston



Mueller's Patent Drop-Valve Gear for Marine Engines.

engine, it was thought that the last days of the piston engine had come. Accordingly almost every important firm of marine engine builders commenced to direct their attention to the construction of steam turbines. But only very few of the turbines thus made have come up to the makers' and owners' expectations; and to-day even the most successful of turbine builders will, if they are to express their unbiassed opinion, admit that the victory of the turbine over the reciprocating engine is still very distant.

Both have their advantages and disadvantages, and it will always depend upon the specific conditions to be dealt with to decide which of the two is likely to work more economically. However, while the steam turbine gradually gained a footing, the piston engine has not by any means stood still; and it may be

safely asserted that, with the exception of warships, where small space, particularly height, is of paramount importance, the piston engine is, not only not excelled, but is not even equalled, by the steam turbine. Particular advantages were expected of the steam turbine, owing to its high number of revolutions, in all cases where direct coupling to the driving machinery was practicable, such as in the generation of electricity and in marine practice. But at the beginning no appreciable saving of fuel could be shown by replacing the piston engine by turbines. There are thus, with the exception of the small space required, scarcely any advantages upon which the successful future of the turbine can be based, unless the problem of suitably transmitting the power of the turbine to the propeller shaft be satisfactorily solved, permitting at the same time of a variation of the direction of rotation. For, as is well known, the high speed materially decreases the efficiency of the propeller. Another serious drawback attached to the turbine is that at half-load it consumes considerably more steam than the reciprocating engine under similar conditions, and that it only attains a high efficiency when running under full load.

The weapon with which the piston steam engine has successfully beaten the turbine is the application in marine-engine practice of superheated steam, and in this respect the piston engine will always retain its superiority, owing to its capability of utilizing the falls of temperature, a feature which belongs to the piston engine alone; and, however perfect its design may be, this special feature can never belong to the turbine.

To-day a large number of small and large vessels are worked by superheated steam. The first engines so operated were fitted with piston valves which gave good results at the low degrees of superheat then used. Experience has shown, however, that the most economical and dependable working is obtained by superheated steam engines fitted with valve gears. Although both the piston valve and the valve form a truly round body, the expansion of which when heated is uniform, they have the drawback that the surfaces slide on one another. The friction thus caused may be reduced to a minimum with piston valves without packing rings, but their perfect steam tightness is invariably of a short duration. There are some steam-engine builders who in such cases pacify the shipowner by assuring him that the steam passing through the leakage is by no means lost, but utilized in the low-pressure cylinder. This, however, is not quite correct, as the utilization of this steam is an unfavourable one, and many a shipowner has had the experience that by replacing his piston valve by a new one the consumption of coal has suddenly been greatly reduced.

One of the reasons why the introduction of valve-gear engines was slower than anticipated was that most of the valve-gear systems were too complicated to ensure absolute reliability of working.

One of the most interesting and simplest forms of valve gear is that of Paul H. Mueller. The illustration herewith shows the gear for the high-pressure cylinder of a marine engine of $20\frac{3}{4}'' \times 35\frac{1}{2}'' \times 4'\text{-}8''$ diameter and $37\frac{1}{2}''$ stroke. For reversing, Stephenson's link motion is employed.

The prominent features of the Mueller valve gear as used for marine engines are its exceedingly great accessibility and compact build. All its parts are in full view and permit of unobstructed examination during working. By means of the intermediate lever, fitted with two rollers, an absolutely concentric pressure upon the valve spindle is obtained, and the lateral pressure, such as occurs in other systems and results in a quick wear of the spindle and its guide, is obviated. Absolute steam tightness of the valve spindle has thus always been ensured. The arrangement of this lever has furthermore the advantage that owing to the favourable motion of the valve, as experience has invariably proved, the working of the whole valve gear is a very smooth one. The satisfactory working of the valve gear is moreover enhanced by the spring, which, absorbing the acceleration of the reciprocating masses, acts immediately against the valve. This spring is located in a separate casing, whereby absolute safety is ensured even in the case of a breakage of the spring, which, we understand, has not occurred so far. It is thus rendered impossible for any parts of the spring, should, through some cause, a breakage occur, to get into the gearing.

A further important feature of this arrangement is that the valve spindle and valve are each centred independently, and that no screwing up with the valve spindle is necessary. Every single part of the gear is guided by itself, so that no jamming owing to unequal expansion through heat can take place, and a positive and sure action of the valve is secured.

The valve gear gives very ample sections, which, particularly with the usual cylinder charges, exceed those of a slide valve. Altogether Mueller's valve gear embodies all the improvements suggested by many years' experience, and constitutes a simple, most reliable and durable valve-motion mechanism. By reason of the absolute safety of working, even with highly-superheated steam, engines fitted with this valve gear are sure to greatly extend the use of the fuel-saving working with superheated steam on vessels of all descriptions.

Further information as to this valve gear will be supplied on application to Mr. O. N. Beck, of 11, Queen Victoria Street, London, E.C.

THE HISTORY AND PRACTICE OF LUBRICATION IN MARINE ENGINES.*

By Mr. J. VEITCH WILSON.

[*Continued from Page 264.*]

IT may interest you to have a brief description of the leading processes involved in the manufacture of shale oil and I have with me two illustrations and a few samples which will help you to realize this. In the case of the Broxburn Oil Co., the works are situated at the base of a gently rising hill. Unlike the ordinary coal or shale pits in other parts of the country, the Broxburn mines are approached by inclined planes, technically and locally referred to as "ingaun-ees" which enter the hill side on the level of the shale, whence it is brought from the mines in trains of waggons operated by an endless rope. The shale comes to the surface in large blocks and the first process is to reduce these blocks to small pieces not exceeding in size those which I now show you, as it is desirable that the largest possible surface in relation to the weight of the shale should be exposed to the action of heat in the retort. The shale is broken

* Read at the Institute of Marine Engineers on 19th of December, 1910. Chairman, Mr. James Adamson, Hon. Sec.

by ordinary stone-crushing machinery, on leaving which it drops into small waggons which, by an endless chain, are drawn to a platform at the top of the retorts. Many forms of retorts of as many different shapes have been used for the distillation of shale. The earlier retorts were generally similar to those used for the production of gas and were built in ovens in the same manner as gas retorts. This involved the use of coal to heat the retorts and generally called for the consumption of about 5 cwt. of coal to a ton of shale. It was, moreover, found that while in the production of gas one constant temperature alone is required, the extraction of the different volatile constituents of shale called for the use of different and carefully graduated temperatures. Time does not permit me to describe to you in detail the many changes and modifications which were introduced to effect this, but I shall describe to you the Henderson, which is probably the latest and most efficient now in use.

The Henderson retort is a composite structure measuring 63 feet from ground level to the top of the feeding hopper, 14 feet of the upper portion is of cast iron resting upon a firebrick portion of 20 feet in height, the rest of the total height being accounted for by the hopper and the charging gear at the top and a lofty chamber below for the reception of the spent shale. By arrangements, to which I shall subsequently refer, the temperature of these retorts is so regulated as to give the lowest temperature, say, from 800 to 1,000°F., at the top, a temperature of 1,400 to 1,500°F. about the middle, and a temperature of 1,800 to 2,000°F. in the lower section of the retort, this latter temperature being equivalent to that at which gas retorts are usually worked. Each of these retorts contains a charge of 16 tons, which passes slowly downwards through the different zones of temperature at the rate of 4 to 4½ tons per diem, and is replaced at the same rate. When, by means of a single charge of coal the operation of the retort has been started, no further coal is required, as the shale passes slowly downwards in a state of incandescence and the shale at the highest temperature is discharged at the bottom, the hot gases passing upwards from the charge together with superheated steam serving to ignite and to distill fresh shale. This action is promoted by the return of incondensible gas from the condensers to the bottom of the retort, where it is consumed as fuel. The shale, entering the relatively cool zone at the top of the retort, encounters the lowest temperature which, as we have already seen, may be from 800 to 1,000°F. and gives off the lighter products *viz.*, spirit and light oil. Passing downwards to the central section it is exposed to a temperature of 1,400 to 1,500° and yields heavier lamp oil, lubricating oil and paraffin wax Continuing its downward progress it enters the lowest section, which is maintained at a temperature of 1,800 to 2,000° Fahr., approaching that attained in gas making as, at this stage of the process, the results sought for are akin to those required in gas production. At this latter stage, an interesting chemical and economic action occurs. In operating these retorts it is customary to introduce a continuous current of steam, part of which passes upwards unchanged through the retort and promotes the removal of the hydrocarbon gases as soon as they are formed, while part is resolved into its elements, oxygen and hydrogen. The former, oxygen, unites with the residue of carbon still present in the shale and forms carbonic oxide gas while the latter, hydrogen, combines with the nitrogen of the shale and forms ammonia. After leaving the retort all the gaseous products pass through stacks of vertical iron pipes in which the steam and the heavier oil and ammonia gases are condensed and drawn off, while the lighter gases are conveyed to coke towers in which they meet a continually descending shower of water and oil which condenses the remainder of the ammonia and naphtha, from which petrol is produced, the remaining incondensible portion being, as I have already said, conveyed by huge pipes to the combustion chambers under the retorts. The lightest spirits are refined by distillation, by steam heat and by washing with sulphuric acid and soda to remove the smell. The heavier portions of the oil containing lamp oil, lubricating oil and paraffin are transferred to a battery of boiler-shaped stills. The battery comprises, 1st, a central still to receive the crude oil; 2nd, on each side a heavier oil still, and 3rd, beyond these two, coking stills for the heaviest oil. The process is, the crude oil enters the central still, in which it is subjected to a current of steam and moderate heat sufficient to volatilize and carry off the lighter fractions, including a small percentage of spirit and the burning oil, while the heavier oil, by reason of its heavier S.G., sinks to the bottom of the still, whence it flows by a pipe into the next still, in which it is delivered on a level with the surface of its contents, conveyed by pipes to the two adjoining stills from which, by higher temperature, the intermediate oils are distilled off, the residue being carried by pipes to the coking stills which are maintained at a temperature sufficiently high to carry off the lubricating oil and the paraffin wax, while the final residue is reduced to coke. The various distillates are collected in separate tanks, from which they are transferred to washing vessels allotted to each. In the first of these the oils are agitated with sulphuric acid to remove the tarry matter which they contain, and thence to other washing vessels in which they are agitated with caustic soda to neutralize the trace of sulphuric acid which remains after the first process and to remove other tars. The operations of distillation and washing may have to be repeated several times. The heavy oil from the last distillation, which contains the lubricating oil and paraffin, is exposed to cold, which causes the paraffin to crystallize and the mass is then forced through filter presses which separate the oil from the wax. The oil is refined by treatment with sulphuric acid and soda, as I have already described, while the wax is placed in huge shallow trays, tier above tier, or in large vertical cylinders in a house specially constructed for their reception and subjected to moderate heat, which causes the remaining oil to drain off and leaves the refined paraffin, of which this is a sample, ready for candle making. The ammonia water is placed in suitable stills to which heat is applied, the ammonia gas, which is distilled from the water, is conducted by pipes to lead-lined tanks containing sulphuric acid under the surface of which the gas is discharged through perforated lead pipes, the ammonia gas combines with the sulphuric acid and forms a solution of sulphate of ammonia and is allowed to settle. This is then transferred to evaporating tanks in which the water is removed and commercial sulphate of ammonia, represented by this sample, and forming a valuable manure, is produced.

I have no information, and I fear that no record exists, regarding the lubricants used, or the methods adopted for applying these on board early steamers of the opening decades of the nineteenth century. I think, however, that, from our knowledge of the materials which were then available and from some traditions regarding land practice which have come down to us, we may safely assume that for cylinders they used suet or tallow which was kept in a kettle on the top of the cylinder and introduced intermittently through a grease cup on the cylinder head. As for the bearings, I fancy that sweet oil of some kind would be used. By "sweet" oil, olive oil or some similar refined oil is generally referred to in contradistinction to the malodorous whale or "train" oil. How whale oil should have got this name often puzzled me, but, without claiming to be an etymologist, I think that I am warranted in suggesting that it is derived from the German word "Thran," which means "train-oil" or "blubber." The method of application would probably be through oil boxes or cups fitted with syphons, and I imagine that much of the work and responsibility would devolve upon the engineer himself. I made my first acquaintance with marine engines in the early "fifties," when my parents went to reside in Greenock, and I had the opportunity of making occasional trips on Clyde steamers to the Gareloch or Dunoon or even to Rothesay. We boys rather fancied ourselves as experts in these days and were prepared to discuss, on occasion, the merits of all types of engine, "steeple," "diagonal" or "oscillators." On our little sails we watched the engineers as they performed their many duties and we used to be thrilled with excitement when, while the engines were heaving and rocking, we saw the engineers creeping and crawling about the moving machinery, hanging on to a rail here, dodging a crank or a rod there and, between times, bestowing a few drops of oil upon the crank pin or on the guides or on the rising and falling levers. We hardly knew whether to admire more their skill or their bravery.

And now, leaving these pleasant reminiscences, let us consider the conditions which occur in a steamship of the present day in regard to lubrication and the nature of the materials required to meet these. Let us begin with the cylinders. In the early days of which we have spoken, pressures were little above atmospheric, but, with extending

knowledge of the properties of heat and with improvements in construction, pressures and temperatures were steadily raised, and when I was first practically interested in the subject I found pressures of about 50 to 60 lbs. were in common use and tallow the common lubricant. Trouble was encountered, cylinders were corroded, cotters and bolts were eaten away, but no one seemed to suspect that tallow was the culprit. By and by, as the chemistry of facts became better understood, oil manufacturers and chemists were able to show engineers that they were carrying on in their steam cylinders the same process, although in a feeble manner, that candle manufacturers practised on a larger and more effective scale for the production of material for candle making. The active principle in each case is the same. Fats, when exposed to the action of heat and steam are decomposed and produce fatty acids and glycerin. With the ordinary engine cylinder you are all familiar. The stearine manufacturer calls his cylinder an "autoclave." It is from 8 to 10 feet in length by about 3 feet in diameter, and has hemispherical ends and deals with a couple of tons of fat at a time. It is made of copper, strongly built and double riveted, tested to a pressure of two to three hundred lbs. and works at a pressure of about 120 lbs., equal to about 350°F. A little lime is introduced to promote the process, but the results could be attained without this, so you see that your cylinders are to all intents and purposes autoclaves and calculated to produce the same results. These products are beautifully clean and clear because care is taken to avoid contamination, yours are black and dirty because they get mixed with metal eaten off the cylinders and abraded metal and with primings, but if you separate the fat from the dirt and metal you will find that it has all been converted into fatty acids.

Before saying more about the use of oils in marine engine cylinders, I shall take the liberty of directing your attention briefly to the lubrication of the cylinders of land engines which present a greater variety of conditions. For our purposes we must consider land engines—1st, as single or compound; 2nd, as vertical or horizontal; 3rd, as spray or surface condensers; 4th, as to the destination of the water of condensation. The question of *single or compound* is interesting as indicating whether high or low-pressure steam is used. The type *vertical or horizontal* affords a clue to the amount of friction to be overcome, since it is evident that, in a horizontal engine, there must be more friction from the weight of the piston on the lower side of the cylinder than in a vertical engine in which the pressure on the cylinder walls is only that due to the tension of the rings. It is better, therefore, when no other consideration forbids, to use an oil containing a little fat in horizontal cylinders, although a pure hydrocarbon is usually sufficient for verticals. The system adopted for *condensation* is important in respect to the action of the lubricant upon the condenser tubes and the boiler flues. When a *spray* condenser is used the water of condensation is largely diluted and is passed into a pond or storage tank in which the oil rises to the surface and pure water is drawn off for the boiler, but in the case of a *surface* condenser all the water of condensation, with all the oil carried over from the cylinder, is returned to the boiler. In this latter case only pure hydrocarbon oils are permissible. My advice to land engineers, therefore, invariably is to use compound oils in all horizontal cylinders and, by preference, in verticals when necessary, provided in each case surface condensers are not in use. But while the lubricants may be the origin of deposits and the cause of corrosion in cylinders the lubricants are not to be held solely or even primarily responsible for the trouble arising from these sources, which may be largely due to faulty construction or to the material used in the engine itself. Faulty construction includes imperfect arrangements, for the exhaust by which the material used for lubrication is allowed to accumulate in the cylinder, producing balls and attacking the cylinder itself. Faulty construction also includes the use of long vertical pipes which collect the atomized lubricant and permit it to find its way back into the cylinder. I remember a case of this kind in the North where friends of mine were troubled by deposits in their cylinders and asked me to have a look at them. On doing this I found a compound horizontal engine with an exhaust pipe rising 8 or 10 feet vertically to an oil separator filled with chains to catch oil and prevent it from getting into the boiler. But my friends had overlooked the fact that the vertical pipe was in part doing the duty of the separator and returning much of the oil to the cylinder. I had a similar case a few years ago not a hundred miles from where we now stand. In that case my friends had a large air pump exhausting into the atmosphere through a pipe of ample dimensions rising vertically about 12 or 15 feet, which served as a sort of economizer and returned to the pump the oil which it collected on its sides. I referred also to the metal, of which the cylinders were made, as a contributary factor in the trouble encountered in these. I was much perplexed in my early days by the fact that I found cases in which tallow was used with perfect satisfaction, while in other cases, and apparently under practically identical conditions, it caused endless trouble. The first light which I had on this problem was given to me by an old gentleman who was manager of a large steel works in Sheffield. This gentleman had under his charge about 100 engines of various sizes and told me that, while tallow was used in all these cylinders, some of them had run without trouble all the time that they had been under his charge, while others had required repairs or new cylinders several times. "Now," he said, "the tallow was the same and the water was the same, and what do you make of that?" And as the only possibly reply I said "metal." "Right you are," said he. So I added something to my stock of information. I hope, therefore, that if and when you should unfortunately have troubles from deposits you will not hold the oil wholly and solely responsible for these.

There is one other hint which I should like to offer you with regard to the action of fatty acids upon metal, it is this. The chemical action of these acids takes time, and if you prevent deposits you prevent corrosion. This object may be attained in various ways—1st, mechanically, by seeing that the exhaust thoroughly clears the cylinder at every stroke; 2nd, by using a lubricant in which hydrocarbons largely predominate and the percentage of fatty material is reduced to the lowest quantity consistent with efficiency. In addition to the troubles arising from deposits in cylinders, condensers and boilers in land engines, I find that in marine engines there is another trouble, *viz.*, "pitting," usually attributed to the galvanic action set up between the water and the plates. I understand that two methods are adopted for the prevention of "pitting;" one is the introduction, either in a solid or a liquid form, of zinc, which, being more amenable to galvanic action, attracts it to itself and saves the plates. The other method is by permitting the formation of a thin film of scale on the plates to protect them from the galvanic action. Possibly a film of oil over the plates might be equally effective, but this does not seem to have commended itself to marine engineers. Both kinds of film are open to objection in respect that they are non-conductors, scale probably to a greater extent than oil, and entail risk of overheating with the dangers which that involves. However, on the sound principle that, of alternative evils it is better to choose the less, I understand that marine engineers prefer a thin coating of scale to a film of oil on the plates of the flues, and that, moreover, as the presence of oil is inimical to the formation of the protective scale, the use of oil of any kind is barred in marine cylinders. Under these circumstances it is unnecessary to devote much time to the consideration of lubricants which are not called for in ordinary marine practice, but it may be of interest if I give you a brief description of these oils.

Our best steam cylinder oils are produced from crude petroleum. The crude oil is placed in a boiler-shaped still to which external heat is applied and the lighter fractions, spirit and lamp oil, are driven off. Naked superheated steam is then introduced to the still, the contents of which are thoroughly searched by the steam and the heavier fractions, representing the intermediate and lubricating oils, are removed. The oil is then filtered through some mechanical medium such as canvas, wire gauze or cotton waste to remove sand, grit and other impurities. This gives us the natural or dark cylinder oil of commerce, as per the sample now submitted. These "natural" cylinder oils are very largely used and generally give satisfaction, but there are many cases in which they fail to do so, and I shall call your attention to what I regard as the reason for this and the cure. You will remember that in the early references to these oils which I quoted, they are spoken of as "tar, pitch, bitumenn," and sometimes as "slime," and that in the early patents for the distillation of "rock or coal," the products are described as "tarr, pitch or oyle," which shows that their bituminous

character was generally recognised. In proof of their bituminous nature it is found that, by distillation, the valuable oils may be extracted, leaving the pitch behind as a heavy liquid residue in the still. This pitchy residue is again subjected to distillation at higher temperatures and yields lubricating oils and paraffin wax, leaving in the still a hard, dry honeycomb coke, equal to about one-fourth to one-third of the original residuum or about five to ten per cent of the original crude petroleum. Now, in producing natural cylinder oils, by the process which I have described above, no provision is made for the removal of this carbon or coke, which is not a separate material distributed through the oil, but is one of the elementary constituents of the oil itself. It may, however, be eliminated by one of two methods: 1st, by distillation, but the distillate, although greatly improved in appearance and quality and well adapted for use on light machinery, is deficient in body and unsuitable for use in steam cylinders. 2nd, by filtration through animal charcoal, which is always effected at a high temperature and is frequently promoted by dissolving the oil in some oil or spirit which is removed by distillation after filtration has been finished. By this process we obtain oils of the vaseline class, which are generally described as "charcoal filtered or refined" These oils are lower in gravity and in body than the "natural" oils, but as this change is due to the withdrawal of bitumen, which cannot be regarded as a lubricant, their value is not impaired, while their efficiency is increased by the greater facility with which they permeate steam and the greater readiness with which they spread themselves over hot surfaces. I think that you will agree with me that these charcoal refined oils from which the tar has been extracted are less likely to leave deposits in cylinders than those oils in which the tar is still present. I must in fairness say that in many cases these "natural" oils are used with perfect satisfaction probably in cylinders which have an effective scavenging action.

Let us now consider briefly the lubrication of the other parts of the marine engine. Forty or fifty years ago, as I have said, tallow and suet were commonly used for internal lubrication, and at the same time olive oil, rape oil and, occasionally, castor oil were used for bearings. I remember well that in these days the Cunard Company used exclusively Jamieson's refined engine oil which seemed to be mainly, if not wholly, pure rape oil. Mineral oil of any kind was entirely "tabooed," and any oil which showed the characteristic blueish scad of mineral oil was promptly condemned as "blue billy" The objection was well founded and reasonable, since, as all the body of rape oil was required for the work to be done and the body of the best mineral oils was much below that of rape, it is evident that the addition of even a small percentage of "mineral" rendered the mixture unsuitable for its purposes. It happened that in the early seventies of last century the subject of lubrication was several times brought before the Philosophical Society of Glasgow by various members, among whom were Mr. James R. Napier, the shipbuilder, Mr. R. D. Napier, the engineer, Mr J. J. Coleman, chemist, and others. In the course of the discussions which ensued frequent reference was made to the value of castor oil as a lubricant, especially in warm climates, and although it was understood that castor oil would not blend with mineral oil, I was induced to undertake a series of experiments to see whether the difficulty could be overcome. As the result of my somewhat unscientific endeavours I actually found a method of attaining the object which I had in view and was able to produce compound oils containing mineral which had body equal to or greater than the standard rape oil. I got my new oil tried by several shipping friends with perfectly satisfactory results, but still their blue scad was against me, and it was long ere I managed to overcome this prejudice, although I ultimately succeeded in doing this and got my oil accepted as a standard marine engine oil. One incident I remember with amusement. I had had the oil tried on some of the Burns' channel boats and got a good report. So I approached Captain Duncan, who was then storekeeper, for an order, but was told that, although the oil was very good, it would not suit them. I was astonished and asked for an explanation, when the good old man said "the ile's aw richt, but if I gae thae lads twa iles they'll put the lamp ile on the bearins and engine ile in the lamps, an' whaure 'll thae be on a dirty nicht in the Irish Channel?" I never got that order. By and by a new method of thickening vegetable oils was introduced. This consisted in blowing air through rape or cotton seed oil which had the effect of greatly increasing the body of the oil. The process is similar to that adopted in rendering linseed oil more drying, and the result in the case of rape and cotton seed oils was similar, *i.e.*, it rendered them more gummy and liable to dry on machinery. The theory was that when such oils were mixed with mineral oil their gumming tendency was neutralized and a good lubricant was produced at a moderate price. I am not so sure of that, but despite these apprehensions of mine such oils appear now to be almost universally used by nearly all the great steam shipping companies. I have also noticed, during the last few years, that there is a tendency to reduce the proportion of vegetable oil and to compensate for this by using heavier mineral oil in order to keep the body up, and with the small respect which I have for these thickened vegetable oils I think that the change is a good one and will tend to reduce trouble in the engine-room. I should have liked to say more about the relative merits of fatty oils, mineral oils and of mixtures of these as lubricants, but time is short and there are several other matters to which I wish to call your attention. I will only, however, allow myself to say that, although I have been, during all my business career, closely connected with the mineral oil trade, I am still impressed by the idea that fatty oils have some mysterious virtue as lubricants which is not present in mineral oils. I have designed and have now under construction an apparatus by which I hope to be able to throw some light upon this problem, but the machine is not yet ready and I am, therefore, unable to bring any results before you on this occasion, although I may perhaps be permitted to do so on some future date.

For the present, and in order to save your time, I shall content myself by directing your attention to two tables (page 52) in the pamphlet upon "Oil testers and how to use them," which was placed in your hands as you entered this room. The object with which the experiments referred to in this table were undertaken was to determine what effect the body or viscosity of an oil had upon the temperature and frictional resistance developed on a bearing running under precisely similar conditions. It ought to be recognised that perhaps the conditions, weight and speed of the journal were not the most favourable for each oil, or putting it the other way, that the oils were not those which would have been chosen in every case for such a bearing. I had no dynamometer attached to the tester, but I had a slack driving belt which, to some extent, served the same purpose by permitting "slip" until the normal working conditions for each oil had been reached. I was thus enabled to note, 1st, the time taken to attain these conditions, 2nd, the constant temperature at which these conditions were realized, and 3rd, the number of revolutions made in each case during the period of test, which was ninety minutes. If you will refer to this table you will find that the thinnest oil, sperm, took the shortest time to develop maximum temperature, maintained the lowest constant temperature and gave the greatest number of revolutions, while castor, the thickest oil of the lot, exhibited the other extreme in every respect.

Turn next to the table on page 55. It had occurred to me from consideration of the results shown in the table just referred to, that there might be some connection between the temperature at which full speed was attained by each oil and the body of the oil at that temperature, and the second series of tests was undertaken to determine this question. In this table the usual particulars, gravity, flash point and viscosity at various temperatures are given of each oil. In addition to these we find columns showing the "normal working drag and temperature" and the viscosity at working temperature. The "drag" indicates the amount, in eighths of an inch, of the deflection of a pendulum from the perpendicular. The "working temperature" denotes the maximum and constant temperature developed by each oil. The last column is the most interesting and instructive, as it shows that, despite the great divergence in the bodies of the oils at normal temperatures, they had all, at their respective working temperatures, been reduced to approximately the same viscosity. It, therefore, appears from these experiments, as from those of many other investigators, that the best oil for any bearing is the thinnest that will keep the surfaces apart and that thicker oil involves the waste of energy and of fuel, which may be measured by the higher temperature developed on the bearing to reduce the oil to the viscosity appropriate to the work to be done.

These remarks about "body" naturally raise the question of the suitable viscosity of oil for marine engines. This in turn depends upon the size of the engines and the climate in which they are to be employed. Now, as I think that I am correct in saying that all steamship shafts are heavy pieces of goods, that the surface speed may be from 300 to 400 feet per minute and that the temperature of the engine-room and tunnel is something tropical, it is safe to say that a heavy oil is generally required. This is confirmed by the fact that castor oil is largely used and that the samples of standard oil, which I have received from various quarters, all possess high viscosity, say, about half that of "castor." Therefore, it appears to me that, so long as the system of applying the oil, by pipes or syphon, will pass the oil you may safely use any good oil with a body of from half to equal that of "castor."

TURBINES.—My remarks have hitherto related to the reciprocating engine, but, before parting from the steam-operated engine, we must consider the latest development of the earliest form of steam motor with which we are acquainted, *viz.*, the turbine, in which the tightly fitting reciprocating piston and the internal friction which it develops are entirely eliminated. I pointed out, in my earlier remarks, that the first steam engines of which we have any record were turbines, but the idea of a rotary engine never seems to have been absent from the minds of engineers who did not fail to recognise the disadvantages of the reciprocating engine. Watt was among those who sought to improve upon the piston engine and, in 1782, devised a rotary engine of which particulars are not before us. He was followed by Bramah, the inventor of the lock which bears his name, who, in 1785, took out a patent for what he called a "Hydrostatical machine and boiler for propelling vessels, carriages, etc." In this a cylindrical piston, fitted with vanes, revolved axially in the cylinder. Subsequently Behrens (whose date I have not been able to find) designed his "rotary" engine, in which the form and practice of the "Root blower" is foreshadowed. But as these machines depended for their efficiency upon a steam-tight contact between the rotor and the cylinder, friction was still an important factor in their operation. In later years we have seen the introduction of the "Pelton wheel" and the "De Laval" turbine, in which circumferential friction is avoided, and in recent years we have the "Parsons" and the "Zoelly" competing for favour. In these later types internal friction is entirely eliminated, but new problems and new troubles arise in connection with the lubrication of the main bearings or glands which are subject not only to the high temperature radiating from the casing or trunk, but to that developed by the enormous speed at which they revolve. Lubrication is generally effected by means of a force pump which delivers a constant stream of oil upon the bearings, whence it returns to a large tank in which it is cooled by the circulation through the tank of cold water in pipes.

Despite the utmost care the oil gets frequently mixed with water either from the condensation of steam from the glands or, but less probably, from leakage in the water pipes. The admixture of water causes emulsification and so thickens the oil as to seriously interfere with the operation of the pump and may deprive the bearings of the necessary supply of oil, with disastrous consequences. Under these circumstances animal and vegetable oils, which are liable to be readily saponified, must be avoided and only pure hydrocarbon oils, which are not saponifiable, may be used. But although, according to their chemical constitution, hydrocarbon or mineral oils are not saponifiable, it has been found that many mineral oils exhibit a strange affinity for water and the greatest care must be exercised in selecting oils which are as free from this objection as possible. It would seem natural to select oil of good body to meet the high temperature of turbine bearings, but this is not generally done, probably because thick oils generally have a greater affinity for water than thin oils. I know of one case in which the engineer has gone to the other extreme and is using such an oil as I should recommend for spindles or looms. I suppose that this is possible because the turbine is new and I should expect that when the bearings begin to wear, it will be necessary to adopt a thicker oil. As far as my own experience goes I have found that the best results are obtained when good hydrocarbon engine oils, enriched by the addition of a small percentage of charcoal-refined cylinder oil, are used, but as cylinder oils are liable to amalgamate with water the materials must be carefully selected and the mixture judiciously prepared.

So much for the steam engine as we know it at present. But I understand, from some papers which I have had the pleasure of listening to in this room, and from other sources of information, that you are thinking of radical changes in the form of energy. The first idea which I have in mind, *viz.*, the substitution of oil for coal as fuel in raising steam, will not in any way affect the matter of lubrication and does not here concern me. Next I understand that you have in contemplation the substitution of internal combustion for steam engines, the fuel for the new engines to be derived either from separate producers or from the direct combustion of oil in the engine itself, on the principle adopted in one or other of the well-known oil engines. Now whichever system you adopt, the gas engine or the oil engine, you will have entirely to revise your ideas about lubrication, and although I do not want to frighten you I think that I may safely say that, if you have to worry about your steam engines, you are not likely to fall out of practice, for some time, after you get your "internal combustions" started. The first thing will be that instead of carefully excluding oil from the cylinders you will have to be as careful to see that they are regularly supplied with the proper quantity and quality of oil. You will next discover that, although it was comparatively easy in the case of a steam engine to determine whether deposits or damage came from the lubricant or from the steam, it is a more difficult matter to fix responsibility in the case of a gas or oil engine in which the fuel and the lubricant have the same chemical composition. By way of helping you to estimate the proportionate responsibility of fuel and lubricant for trouble in a gas engine, I would remind you that the relative consumption of these two articles is about 2 to 3 per cent. of lubricant to 98 or 97 per cent. of fuel, either as oil or as gas. Therefore, when you find more than sufficient carbon in your cylinders please remember that you have introduced upwards of 95 or 96 per cent. of hydrocarbon as fuel and something less than 5 per cent. or even 4 per cent. of hydrocarbon as lubricant. You will also have to do violence to a tradition which you have reasonably cherished for many years, the tradition that if oil should, under any exceptional circumstances, be permitted in marine cylinders it must be pure hydrocarbon. The gas and the oil engine require fatty oil. I must, in the first place, explain that the earlier motor engineers, Continental and British, advocated the use of pure hydrocarbon oils as lubricants in petrol engines, upon the theory, in which they were supported by several eminent chemists, that fatty oils would be decomposed by heat, producing fatty solids which would destroy the cylinder and gummy deposits which would fill it up. Now let me give you a few facts. 1st. The leading makers of gas engines, who have doubtless tried all sorts of oils, invariably use and recommend compound oil for their engines. 2nd. Some makers of oil engines use compound gas engine oil for their engines, but some others find it necessary to use oil containing an extra percentage of fatty matter. I will tell you, on the authority of Sir William Crossley himself, how this came about in his case. Some apprentices were putting a large oil engine through its tests in the shop and found it so difficult to start in the morning that one of them was tempted to apply to the piston the contents of an oil can which they found in the shop as they stopped for the night. Next day the engine started without trouble and the same thing was repeated daily till the end of the test. Then the young men took fright in case they had done wrong and told their story to the foreman, who in turn told the manager. Then there was an enquiry and it was found that they had been using pure lard oil and so satisfactory were the results that it was decided that a certain percentage of lard oil should be added to the gas engine oil for oil engines in future. To meet this demand a new oil containing nearly half its weight of fatty oil was introduced for oil engines under the name of oil engine oil. 3rd. There are, besides these, some other makers of oil engines who find it necessary to use pure or nearly pure fatty oil for the lubrication of their engines. Now it is surely evident that, if pure vegetable oils or rich compound oils give satisfaction where mineral oils fail, fatty oils must possess some virtue which is absent in mineral oils. Further, since it has been found possible to use such compound oils or pure fatty oils without detriment or inconvenience, it is equally evident that the objections to their use must have been founded on misapprehension. The objections were two :

1st, the liberation of fatty acids, 2nd, the formation of gummy deposits. I think that I can show you that both are unfounded. The first, because the presence of free oxygen is necessary for the production of fatty acids, the second, because, as I shall show you presently, the fatty oils, which contain a high percentage of oxygen, burn almost without smoke, while the mineral oils give off, during combustion, large volumes of smoke which is unconsumed carbon. I leave you to judge which, the fatty oils or the mineral oils, are likely to be more responsible for carbonaceous deposits in the cylinders.

When account is taken of the fact that in any internal combustion engine the furnace is found in the cylinder itself and that the temperature of the almost continuous explosions is between 2000 and 3000 degrees Fahr., it must at first appear somewhat of an anomaly that a thinner oil should be used for the cylinder of a gas or oil engine than for that of a high-pressure steam engine. A moment's consideration will dispel the apparent anomaly. For it is to be remembered that, while in the Otto cycle, the compression and the explosion strokes generate heat, they are followed by the exhaust stroke, which reduces the pressure and the temperature, and by the induction stroke which introduces a comparatively cool charge and also tends to reduce the temperature. Moreover, the cylinders and, in some cases, the pistons are water-cooled so effectively that the temperature of the walls of the cylinder does not exceed about 250 degrees Fahr.

On the other hand, every care is taken by jacketing with live steam and by "lagging," to keep the temperature of a steam cylinder as high as possible in order to avoid condensation. But a steam pressure of 100 lbs. gives a temperature of 329 Fahr., 150 lbs. gives 358 lbs. Fahr. and 200 lbs. which, I understand, is a common pressure in modern marine engines, gives 382 Fahr. without superheat. If, to the latter figure, we add say, 150 for superheat, we get a total of 530 Fahr. for steam as against about 250 Fahr. in a gas engine. Some people are in the habit of talking very learnedly and rather dogmatically for high-flash point in oils to meet such high temperatures. Let me tell you that, as far as safety is concerned, this is all moonshine, because, as is well known, the boiling point and consequently the evaporating point of liquids are affected by pressure and therefore the flashing point of oils is likely to be very much higher at these high pressures than those which we test, and when we test them at normal atmospheric pressures. But, even if the flashing point of cylinder oil were lower than that of the steam with which they are to be used, how could ignition take place in the presence of steam and the absence of oxygen? Under such circumstances, flashing point is only of value as an indication of another property, *viz.*, the rate of evaporation, but even this property would be controlled by pressure and would probably be lower at high than at low or normal pressures. I do not, however, and I would not have you overlook the fact that the pressure in a steam engine is a fluctuating quantity varying from maximum to something under atmospheric, and it is possible that, under the latter condition, evaporation may temporarily occur.

Report of Discussion.

At the Institute of Marine Engineers on Monday, January 23rd, the adjourned discussion took place on Mr. J. Veitch Wilson's lecture on "The history and practice of lubrication in marine engines." Mr. Jas. Adamson (hon. secretary) presided.

A contribution was read from Mr. W. Calderwood, who said, in connection with the author's recommendation of compound oils for cylinder lubrication, that the presence of a large percentage of mineral oil with fatty oils would not prevent the action resulting in the formation of glycerine in the cylinders and causing trouble in the way of pitting and corrosion. He advocated the use of a pure hydro-carbon oil for cylinders, but for general purposes he did not recommend mineral oils only; he felt that fatty oils could not be dispensed with until less attention was paid to the initial cost and more required in the way of purity. A higher grade of refinement should be demanded, and not so much that the cheapest oil purchased answering certain well-known chemical and physical tests, none of which reached the root of the evil.

Mr. J. Duncan Best said there were few people in the country who were more capable of giving an address upon the subject under discussion than Mr. Veitch Wilson. The science of lubrication was an empirical one, depending mainly upon the results of practical experience. As had been said, the oils to be avoided as cylinder lubricants in marine engines were mineral oils which were not stable, in other words, unsaturated compounds; oils with a low power of cohesion, and also those with too high or too low an adhesion. Corrosion did not take place in the cylinders through the use of compound oils, principally because corrosion was a matter of time, and the fatty acids were carried away before they were able to work any harm, and, further, they would not act in a dry atmosphere. The surface tension of vegetable oils was demonstrated to be greater than that of mineral oils. A film of vegetable oil on a bearing would, therefore, stand a greater strain without rupture than a film of mineral oil. Although the absence of "frothing" did not indicate that the oil was bad as a lubricant, it would be reasonable to expect that the oil which did froth would be satisfactory.

Mr. J. Brooker pointed out, in reference to the question of oils in cylinders, that even in a vertical engine there was a considerable piston pressure on the cylinder walls. In the modern steam engine the steam was so dry that it had no effect in decomposing the fatty oils. The amount of moisture also in an internal combustion engine was so small as not to produce saponification. In an emulsion where oil was closely associated with water, he considered it was more a physical effect than a chemical association.

Mr. A. H. Mather said, in reference to turbine lubrication, that experience had proved the necessity of employing different methods of forced lubrication and filtration from what had at one time prevailed. The practice of using thick or thin oil in turbine lubrication varied in different countries. In this country fairly thick oil was used, although it was thinner for land plants than in marine practice. He assumed the reason to be that in other countries the turbine speed was usually slightly higher. He did not think cotton seed oil would stand so well as rape seed oil with heated bearings.

Mr. John McLaren described an apparatus where pure distilled water was introduced into the bearings to form a mixture with the oil as a lubricant.

Mr. A. Robertson said he understood the Bryson retort was an improvement upon Henderson's retort described by the author, in the manufacture of oil from shale.

Mr. J. Clark referred to the fatigue of oils and said that whether due to long use, heavy pressures or atmospheric conditions, some oils seemed to become deficient in quality.

Mr. E. Shackleton referred to the use of animal and vegetable oils for aeroplane machines and for internal combustion engines on land.

Mr. J. Veitch Wilson in replying, said in reference to the question of corrosion in cylinders that the construction of the cylinder itself was an important matter, apart from the question of fatty acids, and with a free exhaust there would be little fear of damage. The specific gravity of an oil was a great consideration; he did not recommend the use of heavy oils as lubricants as they were more likely to contain carbonaceous and bituminous products. He did not look upon the frothing of oils as a good test of their quality. Oils which had been in use probably lost some of the hydrocarbon elements, but they could easily be made up to the required strength. Cotton spindles ran from six to eight months with one supply of oil.

REVIEWS.

Steam and Steam Engines. By Professor Jamieson. 10/6. London: Messrs. Charles Griffin & Co.

That the seventeenth edition of "Steam and Steam Engines" has just been published says much for the favour which Professor Jamieson's work continues to receive. It should be noted that in this edition there are new folding-plate illustrations which excellently portray both the land and the marine types of Messrs. Babcock & Wilcox's water-tube boilers, to which is added a concise description of the latest up-to-date improvements therein. Excellent illustrations of this Company's chain grate stoker for land boilers are also given. The Hopkinson Ferranti stop-valve is well illustrated and

described in accordance with "Bernouilli's Theorem." This novel and interesting type of stop valve is now recognised as being admirably adapted for use with highly-superheated steam, owing to its construction and to the special material of which the valve and its seatings are made. At the end of the lectures upon "Steam turbines" there is inserted a concise comparison between the speeds of the best trial-trip performances of H.M.S. *Bristol*, which has been fitted with the Brown-Curtis type of turbines, and those of three recent but larger British cruisers, and of three similar men-of-war belonging to the United States of America which were each fitted with a different kind of prime-mover. There are some additions to the different appendices; for instance, to Appendix A has been added the latest Board of Education Rules and Syllabus for their examinations on "Heat Engines," and in Appendix D have been printed a number of answers to previously unanswered questions. In order to make sure that all engineers should be made acquainted with electrical engineering terms and units of measurement, to Appendix E have been added the definitions and symbol letters for the fundamental units of the C.G.S. system, Derived Mechanical Units and Practical Electrical Units. The whole book has been carefully revised and brought up-to-date, and we consider the volume to be a splendid text-book for all readers.

Applied Mechanics. Eighth Edition. By Professor Jamieson. 6/-. London: Messrs. Charles Griffin & Co., Ltd.

The present edition of this work is the eighth which we have received, and that it has been found necessary to publish it, owing to its demand, within one year from the issue of the seventh edition, must be most gratifying to author and publishers alike. "Applied Mechanics" is the first of a series of five volumes dealing with mechanical engineering, the remaining volumes dealing with strength of materials, structures and graphic statics, hydraulics and the theory of mechanics. An Appendix A has been added to this edition, as to the regulations by the Board of Trade, which gives general and definite instructions to the candidate as to the divisions in this subject, the first division being restricted to strength of materials and structures, for the needs of students engaged in the building trades or in the offices of civil engineers, and the second division relating to theory of machines and hydraulics. The arrangement of this subject in five volumes is most suitable for students for this examination, Volumes IV. and V. giving the subjects for the second division. In the former edition many unanswered questions to ordinary and the Civil Engineers' examinations were included. These have been carefully answered in the present edition, and have been arranged in the Appendix B under two distinct headings, *viz.*.—(1) The Board of Education and the City and Guilds of London; and (2) The Institution of Civil Engineers for their A.M.I.C.E. Examinations. Owing to the necessity for all engineers to become correctly acquainted with electrical engineering terms and units of measurements, there have been added to Appendix D, the definitions and symbol letters for the fundamental units of the C.G.S. system, Derived Mechanical Units and Practical Electrical Units. The whole book has been most carefully revised, and all the latest examination papers obtainable have been added.

La Marine de Guerre. A. Sauvaire Jourdan. Paris: Librairie Vuibert. Frs. 10.

The book under review is a lengthy volume written with a desire to make the French fleet attractive to the youth of that country, whilst at the same time being interesting to all Frenchmen who wish to read about the fleet of their country. Vice-Admiral Fournier has written an extensive preface, and the illustrations are by M. D'Albert Sebille, of which several are full-page ones. The author commences to describe generally the ports of France, giving their special aspect, which are illustrated with excellent maps of the arsenals, and also, on a smaller scale, maps of the environs of the ports. The development of ships for war is dealt with, traversing quite a large area from birèmes and trirèmes up to the present time. Some attention has been given to the rivalry which has been set up between England and Germany. The chapter devoted to marine artillery is beautifully illustrated, and gives full information as to the light rapid fire and the heavy maritime guns, showing a detail of the breeches with the loading apparatus. Excellent sections of the *Danton*, of 18,300 tons, and also of the *Jean Bart*, of 23,400 tons, which is said to be now in course of construction, are given. The author proceeds to deal with the *personnel* of the navy, and describes their life on board the various vessels and in the ports. This part of his work is well illustrated by numerous sketches. The chapter upon the apparatus used in submarine work is particularly well written to show the form and operations effected by the submarines, and is well worthy of attention by those who are interested. It is to be noted that this chapter on submarines as made by the French Navy is in accord with the views of Vice-Admiral Fournier, who goes so far as supporting, in addition to a suitable navy, the addition of a great flotilla of which the major portion should be submarine craft. This book, of 375 pages, is filled with numerous sketches and illustrations, and is replete with excellent articles, and the volume provides most interesting reading matter, both for young and old.

Gas Engines. By W. J. Marshall and Capt. H. Riall Sankey, R.E. Price 6/- nett. London: Messrs. Constable & Co., Ltd.

This is a work of fairly small dimensions, having regard to the magnitude of the subject which has been written, not so much for those who are concerned either in the design and manufacture of gas engines or for the students of thermo-dynamics, but is intended to be a useful compilation of gas engine information for purchasers or users who desire to know the principles underlying the design and construction, the methods of diagnosing defects when they occur and the desirable steps to be taken to remedy such defects. The theory of the gas engine must of necessity be treated in order to make the subsequent matter intelligible to readers, and this has been done in an admirable style without going into unnecessary mathematical detail. The Otto cycle and the two-stroke cycle engines are fully explained, as also is the water-cooling of the parts and the ignition of the explosive mixture. A chapter is devoted to the operation of the gas engine, while another chapter deals with the arrangement of a gas engine installation, both of which will, we feel sure, be highly appreciated by the particular class of people for whom the book is written. The subject of testing gas engines is dealt with very completely, as also are the various methods of governing, and it is evident that the information given has been the result of large practical experience. The question of gas and gas producers is dealt with very fully and the information that refers to the various fuels that can be used in gas producers should be of particular value to those owning a gas plant or contemplating the installation of one. We strongly recommend any user of gas engines, who is desirous of knowing what his plant is doing, to study the special points raised in this work.

Gas, Oil and Air Engines. By Bryan Donkin. With Revision by Prof. Burstall and T. Graves Smith, M.I.M.E. Fifth Edition, revised and enlarged. Price 25/- nett. London: Messrs. Charles Griffin & Co., Ltd.

The previous edition of this work was published in 1905, and although there has been no marked departure in design in the development of the internal combustion engine, many improvements in detail have been added and the original trend has been to a greater uniformity of design than has hitherto existed. The necessity for a revised and enlarged edition has been demonstrated owing to the increase in the power developed by recent engines, as for example, the 5,400 H.P. engine which has been constructed to work with blast furnace gas, and a Diesel oil engine with a single cylinder has been built giving 1,200 B.H.P. There have recently been marked indications of the rapid increase in the application of the internal combustion engine for marine propulsion, and important experiments on a large scale are being carried out, and it is desirable that results obtained should be collated as far as possible for the benefit of the profession as a whole. A novel feature in recent years has been the Humphrey Internal Combustion Pump, and full details are given in the book relating to this apparatus. The development of this machine is being watched very closely by internal combustion engineers, and the full description given will be most helpful to them. A new chapter of the theory of the

gas engine has been added, as also has a new section on the chemical composition of power gases. Much new matter has been included in the chapters on gas production for motive power and practical applications of gas and oil engines, while the chapters on modern British gas engines and British oil engines have been practically re-written. This new edition is a distinct valuable addition to our stock of knowledge of internal combustion engines and should prove extremely useful to those engineers who are interested in the subject.

BOOKS AND CATALOGUES RECEIVED.

The Journal of the Institute of Metals, Vol. IV. Edited by G. Shaw Scott, M.Sc., Secretary of the Institute. Published by The Institute of Metals at Caxton House, Westminster. The fourth volume of the proceedings of this Institute has been recently published, and, in addition to several full-page plates and a frontispiece representing a group of members at the University of Glasgow, contains 340 pages. The series of papers read at the meetings of the Institute are included in the volume and make it a valuable addition to the records of scientific investigation. The journal is published twice yearly.

Transactions of the Institution of Engineers and Shipbuilders in Scotland. Edited by the Secretary, Edward H. Parker. Published by the Institution at Glasgow. This is the fifty-third volume of the Transactions of the Institution for the fifty-third session, 1909-1910, and contains 429 pages, in addition to which many full-page illustrations and large drawings are included. All the papers contributed by members and read before the Institution during the session are included in the volume, and form very valuable reading. A frontispiece shows Mr. C. P. Hogg, elected President, 1909.

Tide, Time and Distance Tables for the Year 1911. Messrs. Dobbie McInnes, Ltd., of Glasgow, South Shields, Liverpool and London, have recently issued their well-known and handy tide tables for the current year. There is much useful information in the book, which is of a suitable size for the pocket. The information extends to tides and depths for the principal ports in the United Kingdom, speed and knot tables, docks information and much else.

Ice and Cold Storage Trades Directory and Handbook for 1911. Messrs. The Ice & Cold Storage Publishing Co., Ltd., have issued their eleventh annual edition of the Directory, published at the price of 5/-. Many new names have been added and the whole work has been revised and brought up-to-date. The list of vessels fitted with refrigerating machinery is a very complete one and should be found very useful.

Liverpool Shipping. Who's Who? for 1911. This little book is published by The Journal of Commerce, Liverpool, and the price is 6d.; by post 9d. The title sufficiently implies its scope, which it well maintains. In the present edition many new features are included, the more important being concerning the Port of Manchester, the Garston Docks and the Port Directory and a comprehensive review of shipping for 1910. This year's book is double its original size. All data has been compiled from official sources.

The International Institute of Technical Bibliography, of 57-58, Chancery Lane, W.C., have sent us one set of "Engineering Abstracts," Section I., dealing with Mechanical Engineering. Six other sections are published. These abstracts cover the entire field of engineering and technical science, all new books, articles of scientific value appearing in the technical periodicals, etc., being abstracted and indexed. Thus more than 100,000 books and articles are dealt with annually, and consequently it forms a very complete technical index.

The Port of Liverpool, Its Rise and Progress, is a book of 100 pages, published under the sanction of the Mersey Docks and Harbour Board. In addition to being well illustrated with photo-views of Liverpool, it contains three large maps, *viz.*:—Plan of Liverpool Docks, 1911; plan of Birkenhead Docks, 1911; and plan of the Garston Docks and estate, 1910. Information relating to the Harbour Board, with photographs of its members and premises, occupies first place, followed by the early history of the Port of Liverpool, where we find interesting pictures of the port in early times. Full particulars are also given on the docks, pilotage, buoying and lighting, dredging, warehouses, etc. The volume, which is a very creditable production, is published by Messrs. Littlebury Bros., of Liverpool.

The Trade of Hull and the Humber Ports for 1910, is the fifteenth issue of the series, and is published by Messrs. The Eastern Morning and Hull News Co., Ltd., and has been prepared for and reprinted from the *Eastern Morning News*, of Hull. The book comprises 140 pages, is published at one penny, the postage thereon, thanks to our absurd postal arrangements, amounting to threepence. The title is sufficiently indicative of the contents, and it only remains to say that a mass of information is given forming a review and statistical record for the year which will be found most useful to those interested.

Messrs. Dobbie, McInnes, Ltd., of Glasgow, have recently sent us revised circulars of their several specialities, amongst which we wish to draw attention to "McInnes-Dobbie" Patent Indicators for steam and gas engine work, of which they have several forms for continuous and similar purposes; "McInnes-Dobbie" Improved Bourdon Gauges; Messenger's furnace deformation indicator; Clyde furnace indicator; Hopkinson flashlight indicator; and Seller's Portable Dynamometer. Messrs. Dobbie, McInnes, Ltd., will be pleased to send any of these circulars to interested enquirers. A booklet which is issued by the same firm is called "The Commercial Value of Indicator Diagrams," which, we understand, is in great demand and will be supplied **gratis** on application.

Messrs. Siemens Brothers' Dynamo Works, Ltd., Caxton House, Westminster, have sent us a new and revised price list of steel conduits and conduit fittings. The list is a very comprehensive one.

Messrs. Lancaster & Tonge, Ltd., Pendleton, Manchester. A circular of "The Lankester" specialities, *viz.*:—Limit rings, metallic packings, and steam traps, all of which are noted for durability and sold "on approval." Catalogues will be sent upon application.

Mr. S. N. Brayshaw, Hulme, Manchester. A leaflet relating to the new "Brayshaw" patent gas burner.

Messrs. W. & J. George, Ltd., Birmingham. A circular relating to the new Stereo Pyrometer for ascertaining the temperature of muffles, furnaces, gas retorts, etc.

THE FESTIVAL OF EMPIRE, IMPERIAL EXHIBITION AND PAGEANT OF LONDON, to be held at the Crystal Palace, May to October this year, is receiving satisfactory support.

ASSOCIATION OF ENGINEERS-IN-CHARGE.—On 8th March, Mr. W. A. Tookey will read a paper on "Gas producer plant." The annual dinner is fixed for 25th March.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.—At the fifth general meeting held on 24th February, Mr. A. F. White read a paper on "Superheated steam and marine engines."

THE INSTITUTE OF METALS.—FORTHCOMING LONDON AND NEWCASTLE-ON-TYNE MEETINGS.—Arrangements for the forthcoming meetings of the Institute of Metals are already well advanced. The next meeting of the Institute will be the Second May Leccure, which is to be delivered in London, on Friday, May 12th, by Dr. G. T. Beilby, F.R.S., of Glasgow. The subject of the May lecture will be "The hard and soft states in metals." The autumn meeting of the Institute will this year take place at Newcastle-on-Tyne on Wednesday and Thursday, September 20th and 21st. An influential local committee, of which the Hon. C. A. Parsons, C.B., F.R.S., is chairman, and Dr. J. T. Dunn, honorary secretary, has been formed, and is making such arrangements that the success of the meeting is already assured. There is no doubt that the important and far-reaching research that has been inaugurated by the Institute of Metals into the causes of the corrosion of the non-ferrous metals is responsible in a large measure for the rapid growth in the membership of the Institute that is now taking place.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our Own Correspondent.)

Tonnage Output and New Contracts.—The output of shipbuilding on the Clyde during the opening month of the year, although considerably better than the average for the corresponding period of previous years, yet suffered to some extent from the effects of the prolonged lock-out. February, however, promises, at the moment of writing, to compensate for the deferred activity in launching. During January fifteen vessels of 23,540 tons were sent off the stocks, as compared with 22,770 tons in January last year, and 21,450 in January, 1909. During February, or that portion of it past at the date of writing, over 30,000 tons have been launched. So far the volume of fresh work booked falls very much short of the tonnage launched since the year began, and especially so during the period of February already past. A number of very important contracts are known to be pending for vessels of the highest class for well-known services for which Clyde builders and engineers have extensively built in the past, but nothing definite has yet transpired as to the placing of this work.

Messrs. The Clyde Navigation Trustees are asking tenders —to be sent in not later than March 13th—for a powerful dredger of the bow-well centre bucket-ladder type, which will be self-propelling; and for three steam hopper barges of 1,500 tons or alternatively for four barges of 1,200 tons capacity. The Trust are disposing of one of their oldest dredgers and eight of their small barges; so that, after the new vessels have been obtained, there will be a net decrease in numbers, but a decided gain in efficiency. The dredging plant of the Trust will consist of four powerful dredgers and fifteen or sixteen large barges.

Messrs. Yarrow & Co., Scotstoun, have recently put through highly successful speed trials two motor boats which they have built to the order of his Excellency Nazim Pacha, Governor-General of Bagdad. The boats, which are 70 ft. in length, by 9 ft. 6 in. beam, are propelled by two sets of internal-combustion engines, of 120 i.h.p., of the Yarrow-Napier design, driving twin-screws. The speed, according to contract, was 12 knots, and the mean speeds attained were 12·75 and 13·40 knots respectively during a period of one hour.

Messrs. John Brown & Co., Ltd., Clydebank, the engineering sections of whose large works have been kept in high-pressure activity for a long period, and are sure to be maintained in this state through the order received for the turbine engines to be fitted in the battleship to be built by Palmers Shipbuilding and Iron Co., Jarrow-on-Tyne, are now starting on the actual laying down of the new Cunarder. It has been intimated that the name chosen for the new vessel is *Aquitania* —a classic name, as is customary with Cunarders. The berth from which the *Lusitania* was launched has been strengthened and lengthened, and several alterations have been made in the yard to facilitate the construction of the gigantic hull. In the engineering section of the works another naval contract being steadily proceeded with is the Brown-Curtis turbine machinery for the second-class cruiser *Yarmouth*, now well advanced on the stocks of the London and Glasgow Shipbuilding and Engineering Co., Govan.

Messrs. Wm. Denny & Bros., Leven Shipyard, Dumbarton, together with the associated firm of Messrs. Denny & Co., Dumbarton Engine Works, are as usual very actively employed with important work for ship-owning companies for whom they have already built largely. They have also on the stocks at present four torpedo destroyers, the *Davad*, *Defender*, *Badger* and *Beaver*; while in their fitting-out basin there are two other destroyers of the same class, one of which has just undergone a series of speed trials and the other is preparing to do so. There are a dozen building berths in the yard, mostly all of which are occupied. For the British India Co. two steamers are underway, and for the New Zealand Shipping Co. a large twin-screw steamer of about 11,000 tons capacity, intended principally for the meat-carrying trade, is approaching the launching stage. The firm will also launch in a few days the first of a pair of triple screw turbine channel steamers which they are building for the South-east and Chatham Railway Co.'s service between Britain and France. The second of the two vessels is at present only partially in frame, and both are being erected under covered-in berths. They are slightly larger than the preceding steamers built by the firm for the same service—the *Victoria* and the *Empress*—and have a length of 315 ft., moulded breadth of 41 ft., and a depth of 24 ft. 6 in. to the awning deck, which extends the entire length of the vessel. They are to be propelled at a speed of between 22 and 23 knots by machinery, made by Messrs. Denny & Co., consisting of three Parsons turbines driving three shafts, each carrying a single propeller. A noteworthy departure from previous vessels of the fleet consists in the use of boilers of the water tube instead of the ordinary cylindrical return tube type. These will be six in number, and the vessels with their two funnels and strong upper works will have a fine powerful appearance. For two of the torpedo destroyers on the stocks, Messrs. Denny & Co. are preparing Parsons turbines, while the other two will be supplied with turbines by the Parsons Co., Newcastle.

Messrs. Maclaren Bros., Dumbarton, on February 15th launched a little steel-built vessel christened the *Electric Arc*, of which more is likely to be heard in shipbuilding and engineering circles. She has been built to the joint order of the firm named and that of Messrs. Mavor & Coulson, electrical engineers, Glasgow. Fitted out as a yacht, she has been built primarily for demonstration purposes in connection with an attempted solution of the problem of electrical ship propulsion. The *Electric Arc* is 54 ft. long by 12 ft. beam, and the propulsive machinery fitted on board consists of a 4-cylinder, vertical Crossley gas engine of about 45 b.h.p., using gas supplied from a suction-gas producer installed near the engine. This plant and engine drive a dynamo or generator, which in turn supplies power through flexible wiring to an electric motor, near the stern, directly connected to the propeller shaft. Apart from the comparative novelty of propulsive power being supplied by gas engine plant, the arrangements on this little vessel are of decided interest from the point of view of enabling the revolutions of high-speed internal-combustion engines being brought down to a rate at which good propeller efficiency and high resultant speed for the power developed are likely to be attained. The trials of the *Electric Arc* will take place shortly on the Firth of Clyde, and will certainly provide experience and data helping towards a solution of the problem of applying electricity to ocean propulsion.

Messrs. Russell & Co., Port Glasgow, have received an order from Messrs Bethel, Gwyn & Co., London, for a st amer of large carrying capacity. The engines will be supplied by Messrs. David Rowan & Co., Glasgow.

Messrs. Robert Duncan & Co., Port Glasgow, have received from Messrs. Thos. Dunlop & Sons, Glasgow, an order for a screw steamer which will have a carrying capacity of from 8,000 to 8,500 tons.

Messrs. David J. Dunlop & Co., Port Glasgow, have contracted to build and engine a passenger and cargo steamer for the coasting and Channel service of Messrs. Wm. Sloan and Co., Glasgow. Messrs. Dunlop & Co. are also reported to have booked the order for a cable-laying steamer of which class of vessel the firm have already produced several.

Messrs. The Scott Shipbuilding and Engineering Co., Greenock, who launched the battleship *Colossus* on April 9th, have put this vessel through her turning or preliminary dock trials in their tidal basin. Notwithstanding the delay caused by the prolonged lock-out in the shipyard, the fitting of the main and auxiliary machinery has been done well within contract time. The Scott firm, on February 4th, launched the 10,000 ton twin-screw steamship *Hildebrand* for the Booth Steamship Co., Liverpool. The vessel is 440 ft. in length and the machinery consists of twin sets of quadruple expansion engines using steam at a pressure of 220 lbs. per square inch.

Messrs. The Campbeltown Shipbuilding Co. launched, on January 31st, the largest steamer ever built at Campbeltown. This was the *Amphion*, of 5,500 tons deadweight, an addition to the fleet of Messrs. J. & P. Hutchison, Glasgow, and the third steamer built for this firm by the Campbeltown Co. The machinery is being supplied by Messrs. David Rowan and Co., Glasgow.

Messrs. S. & H. Morton & Co., Leith, have at present on hand a number of important contracts for Patent hauling-up slipways. Amongst the slipway plant being constructed are one of 1,600 tons capacity for the Bombay Steam Navigation

Co., Bombay; two, each capable of dealing with vessels of 1,000 tons, for the Suez Canal Co., Port Said; three, each for vessels of 800 tons, for the Port of Para; one, for vessels of 700 tons, for Constantinople; and one for Lisbon for small craft. These slipways consist of hauling gear, steam engine or electric motor, rails, tracks, and carriages. Haulage is effected by wire ropes, and in the case of the Bombay slipway, this rope will be 13½ in. in circumference.

Messrs. The Caledon Shipbuilding and Engineering Co., Dundee, have received an order from the Clyde Shipping Co., Glasgow, for a steamer of 1,350 tons. The vessel will be a sister ship to the *Ballycotton*, launched from the same yard about the end of February for the Clyde Shipping Co. It will be employed in the passenger and cargo trade between the more important Irish ports. This order is the twenty-first which the Clyde Shipping Co. have placed with the Caledon Shipbuilding Co.

THE TEES AND HARTLEPOOLS.

(From our Own Correspondent.)

Middlesbrough.

Messrs. Sir Raylton Dixon & Co., Ltd., Cleveland Dockyard, have now got into full swing again, and are reported to be well booked ahead; though prices are low, there is a tendency for them to stiffen and builders are not booking far ahead.

Messrs. W. Harkess & Co. are reported to have secured the contract to build a small steamer the machinery for which will be supplied locally.

Messrs. Smith's Dry Dock Co., South Bank, are reported to have secured the contract to build two steel whaling vessels, which will be fitted with the Deisel oil engines.

Messrs. Richardsons, Westgarth & Co., Ltd., are reported to be very busy; they have recently booked two or three orders which, with the work in hand, will keep them busy for some time to come; they are also busy with land work and their specialities.

Stockton and Thornaby.

Messrs. Richardson, Duck & Co. have secured the contract to build one large cargo steamer of about 8,000 tons deadweight for Messrs. W. & C. T. Jones, Ltd.; they have now a fair amount of work on hand which will keep them busy for some time to come.

Messrs. R. Ropner & Son keep somewhat slack, but are reported to have recently secured an order for a large cargo steamer, but prices are still low.

Messrs. Craig, Taylor & Co. have secured an order to build two large cargo steamers of about 9,500 tons deadweight each, for Messrs. Evan Thomas Radcliffe & Co., of Cardiff. They are now in full swing again.

Messrs. Blair & Co. are reported to have secured several orders to supply the engines and boilers for various steamers that have been placed locally, and are now very busy in every department, being well booked up.

West Hartlepool.

Messrs. W. Gray & Co. have recently booked sufficient orders for twelve months ahead, several being of large dimensions which will keep them very busy. As all the large berths are occupied and delivery could only be given for small coasting steamers, they are also busy in the dry dock department.

Messrs. J. Baird & Co. have placed an order for a cargo vessel for the Baltic trade with Messrs. Craig, Taylor & Co., of Stockton, the engines and boilers for which will be supplied by Messrs. Pollock, MacColl & Co., Sunderland.

Messrs. Irvine's Shipbuilding & Dry Dock Co., Ltd., have secured the order to build two cargo steamers similar to those recently supplied to Messrs. J. A. A. Van Meel, Rotterdam, one of which is for early delivery, having sold their newest steamer, the s.s. *Koophandel*, to Messrs. Gylsen & Co. They also keep busy in the dry dock department.

The Central Marine Engine Works of Messrs. W. Gray and Co. are very busy, and expect to turn out one engine per week during the next twelve months; they are placing on the market an improved pump of the C.M.E.W. type, which is reported to be giving good results.

Hartlepool.

Messrs. Irvine's Shipbuilding & Dry Dock Co., Ltd., Middleton Yard, are reported to have lost the contract for a large twin-screw meat boat for Liverpool owners on account of delivery, and which is reported to have gone to Messrs. Palmers' Shipbuilding Co., Jarrow; they are, however, busy and expect to secure an order which is in the market.

Messrs. Richardsons, Westgarth & Co. are now very busy. They have secured the order to supply the engine and boilers for Messrs. J. Temperley & Co.'s large steamer building by Messrs. Irvines, also the machinery for the two smaller steamers to be built at Messrs. Irvine's Harbour Dockyard to the order of Messrs. I. J. A. Van Meel, Rotterdam. They are also very busy in their speciality departments, having recently booked two sets of turbine machinery complete.

Messrs. Furness, Withy & Co. have recently sold the s.s. *Dahome* (ex-*Lawang*), 3090 tons deadweight, to foreigners for about £4,000.

THE HUMBER AND DISTRICT.

(From our Own Correspondent.)

The Hull & Barnsley Railway Company's New Riverside Pier (Hull).—The new pier is situated on the river Humber and runs from the entrance to the Company's Alexandra Docks in a westerly direction. When completed it will be 1300 feet in length with a width varying from 50 to 125 ft. and will be equipped with warehouses, electric cranes and capstans of the most modern type. Accommodation will be provided for ordinary passengers, emigrants and general cargo. Two of the latest electric belt conveyors for the rapid shipment of coal have been erected and put into use at the west end of the pier by means of which coal can be shipped at the rate of 1,200 tons an hour, *i.e.*, 600 tons per conveyor per hour. The design of the conveyors and the method of their manipulation, whilst allowing shipment to be performed with expedition, reduces the breakage of coal to a minimum, and in addition the spouts, which are telescopic in design, are so constructed as to reach the combings of the ship hatchways and, having a lateral movement, lessen the need for trimming. There is a minimum depth of water alongside the pier of 18 ft. at low water spring tides, vessels being enabled to arrive and depart at any state of the tide, and it will be quite possible for them when using the pier to save two tides which would otherwise be occupied in waiting for water to enter and leave docks.

Marine Engineers' Association.—The annual meeting of the Marine Engineers' Association (Humber district) was held at the rooms of the Association on the 14th February, when there was a large attendance of members. The business on the agenda included the election of officers, etc., for the ensuing year. The retiring president, in the chair, (Mr. C. W. Malan), in his address spoke of the greatly improved position of the association and of the excellent work achieved during the past two years. The elected officers were Mr. G. Grace president, Mr. Councillor D. Livingstone senior vice-president, and Mr. W. Shores junior vice-president; Messrs. A. Lutham and W. Jackson were re-elected vice-presidents for Goole and Grimsby respectively, and Messrs. R. Schofield and A. E. Harrison as auditors. Mr. J. Shepherd being nominated for re-election by the General Council as secretary. On behalf of the members a presentation was made to Mr. A. N. Somerscales, a late president of four years' duration, of a handsome gold guard and pendant and barometer for his work on behalf of the engineers of the district.

Messrs. Amos & Smith, Ltd., engineers and boilermakers, Albert Dock Works, are fully employed, which necessitate working a night shift, several orders for boilers and machinery for trawler owners in the Humber district having been booked. They are also supplying their patent injector for introducing soda or other chemicals into boilers. The branch shop at Alexandra Dock is fully employed on outside work in graving dock, etc., the company having 200 men engaged in this repair work.

The North-East Coast Engineering Works.—This company is fitting up a large shop with plate rollers, shearing and punching machines, etc. It has been registered as a private company with a capital of £8,000, in £10 shares, to take over the business of engineers, ship repairers, etc., carried on in Hull and elsewhere, as the North-east Coast Engineering

Works. The last directors are Messrs. E. W. Clarke and Mr. J. Clarke, jun. The following steamers have been under repair :—s.s. *Poldhu*, s.s. *Blackmoor*, s.s. *Exmoor*, s.s. *Dacre Hill* and the Greek steamer *Myrtoon*, bulwark damage, etc.

Messrs. Stewart & Craig, Engineers and Boilermakers, seem to have started the year in a progressive way, and prospects seem good, as they have several enquiries coming in from various shipowners. The following steamers have been under repair—s.s. *Elloe*, extensive repairs on machinery and boilers, bunkers, holds, etc. ; general repairs effected to s.s. *Rags*, s.s. *Russland*, s.s. *Arel*, s.s. *Winifred*, s.s. *Betty*.

Messrs. Cooper & Co., Ltd., Neptune Engine Works, have had a fair month with repair work, the boiler and moulding shops are well employed with new work ; the company's graving docks have also been engaged with small coasting crafts. The branch shop at Alexandra Dock has been well employed with ship repairs and graving dock work.

Messrs. Woodall & Co., Engineers and Boilermakers, have had a good run on outside steamers in the various docks, especially amongst Danish and Swedish steamers. This firm is always kept busy on the Hull Corporation works, boilers and machinery. The blacksmith's shop is well employed with forgings for several railway companies and orders keep coming in for their patent "Handibloc" from home and abroad.

Messrs. C. D. Holmes & Co., Ltd., Engineering Works.—This old-established firm has been fortunate in securing several contracts for trawlers for local owners, and will be kept at full pressure during the year. The branch shop at Alexandra Dock has also had a fair amount of repair work on several local owned steamers.

The Goole Shipbuilding & Repairing Co., Ltd., are now going in full swing, and have booked several orders for trawlers and small coasters. They have just launched the trawler *Lucida* for Messrs. J. Marr & Son, Ltd., of Fleetwood. She is a handsome model, and will be fitted up with all the latest requirements to Lloyd's highest class, the holds are specially insulated for carrying fish. She is intended for the Iceland and Bay of Biscay fishing grounds. She has a large ballast tank under boiler to carry fresh water for steaming purposes. Powerful engines and boiler will be fitted by Messrs. Earles Shipbuilding Co., Hull. This is the seventh steamer built for Messrs. Marr & Son, Ltd., by this company.

Messrs. Earles' Shipbuilding & Engineering Co., Ltd., are very busy and have work that will keep the yard going all this year. As regards new steamers, they have also been successful in securing the contract for the alterations on the s.s. *Marylebone* and s.s. *Immingham*, belonging to the Great Central Railway Co. The company's outside staff are well employed in repair work.

Messrs. Cochrane & Sons, Shipbuilders, Selby, have in hand a large number of trawlers to build for local owners, also herring drifters and several small coasting steamers, for Fleetwood, Milford Haven, Lowestoft and foreign owners. This firm will be kept employed for the best part of this year.

Messrs. Cook, Welton & Gemmell, Shipbuilders, Beverley, —This firm is well booked up with orders, which will keep them busy all the year.

SOUTH OF ENGLAND AND ISLE OF WIGHT.

(From our Own Correspondent.)

Messrs. J. I. Thornycroft & Co., Ltd., Woolston Works, Southampton.—H.M. Ships *Larne*, *Lyra*, *Martin* and *Minstrel*. —The two first-named torpedo-boat destroyers have been delivered into H.M. Service. The *Martin* has successfully completed her speed trials, and the *Minstrel* is now fitting-out for her trials. Barge for Portsmouth Dockyard.—This vessel was water-tested last month. Firefloat *Gamma*.—This vessel completed her speed and pumping trials, and left for the Thames under her own power. S.y. *Marynthea*.—The hull and machinery for this vessel were completed, and she was delivered to Messrs. Camper & Nicholsons last month. Stern-wheel passenger steamer for Persian Gulf.—The shell and deck-plating of this vessel are now nearing completion. Oil-carrying barge.—The firm have received an order from [illegible] built by them for the same Company about four years ago. Sundry other orders have been received during the past month for small boats, etc. Repairs.—A number of vessels have been under repair during February, among which the Union Castle Company's s.s. *Briton* is receiving extensive alterations to tanks, etc.

Messrs. J. Samuel White & Co., Ltd., East Cowes, I. of W.—H.M.S. *Redpole*, 27 knot torpedo-boat destroyer, the first of three vessels of this class, was handed over to the Admiralty last month. H.M.S. *Rifleman*.—The official sea-trials of this vessel were successfully completed last month and she will shortly be handed over also. H.M.S. *Ruby*, of the same class, commenced her sea-trials about the middle of last month. H.M. Ships *Ferret* and *Forester*, torpedo-boat destroyers of the 1910 programme, are making very rapid progress, and will shortly be ready for launching. An order has been received for one steam barge and one motor barge for the Imperial Russian yacht, *Polar Star*. These boats will be of very high class and completed in all respects similar to those carried by the *Victoria* and *Albert*, and as supplied to H.I.M. the German Emperor for the *Hohenzollern*.

Messrs. Day, Summers & Co., Ltd., Northam Iron Works, Southampton.—The sailing ship *Pirna* has been at the above yard for some time having severe collision damage repaired. She left the port about the beginning of last month. The *Olive* has also been repaired, having also been in collision. The paddle-steamer *Queen*, 170 tons, Messrs. Cosens & Co., has had a new paddle-wheel boss fitted. Messrs. The Isle of Wight Co.'s *Balmoral* and *Lorna Doone* were both on the slip for survey last month. The *Neptune*, for the same Company, which was built at the yard last year, has also been on the slip for painting, etc. The steam yacht *Honor*, 1,020 tons, completed repairs last month, and the steam yacht *Vanduara*, 450 tons, is having boat-skids fitted and the engine-casing raised. The *Medusa*, 630 tons, and the *Catania*, 668 tons, have both completed refitting, and sailed for the Mediterranean. The s.y. *Albion*, 1,116 tons, was in dry dock having tail-shafts drawn for survey, and was followed by the *Niagara*, 1,443 tons, which was also docked for survey. The s.y. *Dotterel*, 164 tons, was surveyed last month and is having a new boiler fitted. Extensive alterations have been made to the cabin arrangements and new masts have been fitted. The instructional turrets which the firm have in hand for the Admiralty are nearing completion. Good progress is being made with the new paddle-boat for the South of England and Isle of Wight Steam Packet Co., and the shell plating is nearly completed. The vessel is to be named the *Princess Mary*. A new boiler has been fitted to Messrs. Topham, Jones & Railton's dredger *Devon*.

Dredging at Southampton.—At the meeting of the Harbour Board on the 7th of last month, the Mayor informed the members that he had received a letter from the London and South-Western Railway Co., informing him that it was the Company's intention to petition against the Board's Bill asking for Parliamentary powers to charge differential dues on vessels using the port. These dues were to be based upon the vessels' draught and were not to apply to vessels drawing less than 32 ft. The business before the Board was the consideration and acceptance of a tender for the final portion of the dredging scheme, which is the portion from Fawley Beacon to the dock entrance. The tenders received varied from £134,000 down to that of Messrs. The Tilbury Dredging Co.'s, which was for £38,600. The lowness of Messrs. The Tilbury Co.'s tender may be partly accounted for by the fact that this Company are engaged in dredging operations here at present and have all their appliances on the spot. The Board's Engineer's covering estimate was £60,000, based on the calculation that there were 1,200,000 cubic yards of spoil to be removed at a cost of 1/- per cubic yard. Owing to the nature of the L. & S.W.Ry. Co.'s opposition not being known, a motion was carried by fifteen votes to thirteen to postpone the acceptance of the tender till the next meeting of the Board, which was held about the end of last month, too late for the decision to be published in the current issue. The dredging question has been the subject of discussion for the past two years, and it seems the matter is to be again delayed. If the Board decide to proceed, and accept Messrs. The Tilbury Dredging Co.'s tender in its present form, the dredging would not be completed till 30th November, 1911.

THAMES.

(*From our Own Correspondent.*)

Chamber of Shipping.—Sir Walter Runciman has been elected as the new President of the Chamber, and delivered his inaugural address on February 17th. He is well-known at the head of several shipping organizations. The other appointment we have already referred to is the Secretary, the Hon. Noel M. Farrer, who has been appointed in place of Mr. W. H. Cooke.

Shipping Companies.—The new liner the *Themistocles*, belonging to Messrs. Geo. Thompson & Co.'s Aberdeen Line, has arrived in the Thames from the builders, Messrs. Harland and Wolff. She has a registered tonnage of 11,232 tons, and has been constructed under the 100 A1 class. She is twin-screw and 517 ft long. The vessel carries first and third class only, and single berths are introduced in the latter case. Almost an identical ship will follow in a few weeks' time. Messrs. The Mercantile S.S. Co. has issued its report; 5 per cent. is paid for the year on the ordinary shares. There was a total credit of £43,486 and a sum of £20,000 is carried to reserve. The Company owns sixteen vessels of 54,958 tons. The cargo-boat trade is therefore doing well at present, it will be seen.

The proposals as to the Port of London, the launch of the *Thunderer* and the *Waratah* enquiry will be found dealt with in other parts of this number.

MERSEY AND MANCHESTER SHIP CANAL.

(*From our Own Correspondent.*)

WORK in this district is feeling the benefit of the recent settlement, and this combined with the fact that there is a very large amount of Admiralty work in hand just now, together with a good amount of repair work, is making a large number of men find employment. While a small amount of merchant work has been placed engineers are fairly numerous.

Messrs. Cammell, Laird & Co.—Every section of the works and yard of this firm are now very fully employed, and the extent of the yard and plant might well be judged by the amount and variety of work on hand. The Argentina destroyer *San Luis* was launched on February 2nd, while the three sister ships are well in plate and will shortly be launched, and be ready for steam trials early in April. Work upon H.M. cruiser *Melbourne* is also making rapid progress, while the super-"Dreadnought" is also occupying the attention of a section of the large staff employed upon Admiralty work. The fire at Messrs. Cammell, Laird's, which occurred on the night of February 10th, doing damage to the extent of over £15,000, will not interfere with the important contracts in hand to any extent, the management having taken every step to ensure this. The *Highland Loch* is now rapidly nearing completion, and her sister ship, *Highland Piper*, will shortly take the water. The steam whaler *Francisco Galles*, for the Madeira Mabore Railway, is nearing completion, and it is expected will reach her destination in tow. In addition to the above many other contracts are in hand. Amongst many repair contracts may be mentioned the Great Western Railway steamer *St. George* for overhaul and repairs, also the Harrison liner *Merchant* and the *Queen Amélie*, both requiring heavy hull repairs.

Messrs. H. & C. Grayson.—This firm also had a small outburst of fire at their premises, but due to their splendid facilities no interruption of work has been caused. Many important contracts are being dealt with. At the yard of Messrs. Clover, Clayton & Co., in which Mr. H. M. Grayson is now interested, a large range of work is also being dealt with.

The Birkenhead Ferries Committee.—A new stage is to be constructed by this committee at New Ferry to handle the increasing traffic. The builders are the Ailsa Shipbuilding Co., of Troon. The new stage will be 130 ft. long by 13 ft. wide, and will, it is hoped, be placed in position during March. Messrs. Grayson are repairing the swing bridge while the removal of the old stage is in the hands of Messrs. Gibney. The New Ferry traffic will be handled from Rock Ferry during the alterations.

Mersey Docks and Harbour Board.—Mr. Robert Gladstone, who has occupied the position of chairman to this board for many years, has resigned owing to ill-health. Mr. Gladstone has for a long time been one of the foremost figures in the commercial life of Liverpool, and has been prominently associated with the progressive policy of the board. Mr. H. R. Robertson, has been elected to the vacant position, and upon taking the chair, while acknowledging the difficulties of his task, stated that his aim and object would be to maintain the Port of Liverpool in its pre-eminent position. Mr. Robertson has acted for some time as Mr. Gladstone's right-hand man, and is well versed in all that pertains to the commercial life of the port.

The Manchester Ship Canal.—The report for the 16th year's working of this Company shows a steady and cheering increase, both in tonnage and revenue, the former being 4,618,070 while the revenue was £555,735, being an increase of £21,676. Important new developments are pending which should in the near future increase the sources of revenue. New lines of steamers have been inaugurated, namely, to Syra, Smyrna, Constantinople, etc., also to Newfoundland and Dublin. Manchester, while the youngest port in the kingdom, is now fourth in importance. Large developments are also taking place at Ellesmere Port, which is the terminus of the Shropshire Union Canal.

The Cunard Line.—The death took place recently of Mr. F. L. Caldecott, who for fifteen years had occupied the position of shipping master. Mr. Caldecott had been in this employ for thirty years. Quartermasters from vessels of the fleet in harbour bore the coffin to the grave, while stewards from the s.s. *Lusitania* were also in attendance. A strong agitation is being carried on by the Cunard and White Star lines for an increase of the length of the piers at New York from 825 ft. to 925 ft. This length would still leave the river fairway wider than that in the Mersey.

The Liverpool Engineering Society.—At a recent meeting of this society an interesting paper on "Illumination" was read by Prof. E. W. Marchant, during which some interesting allusions were made to the absorption of light by fog. Blue light is stated to be more readily absorbed than red, or stated in another way, the wave lengths of light which are commensurate with the dimensions of the particles in the atmosphere are most completely absorbed. When the wave length of light is comparatively long, compared with the diameter of the absorbing particles, the absorption is less. In lighthouses the yellow light from oil lamps has been found to penetrate further than that from electric light.

NORTH-WEST OF ENGLAND.

(*From our Own Correspondent.*)

A Rush of Work.—Last month it was recorded that unwonted activity was to be seen in every department of the yard of Messrs. Vickers, Sons & Maxim, but there seems now to be a bigger rush of work than ever. This is, of course, on account of the orders which have been in hand for some time, and which the firm are anxious to make as early a delivery of as possible. There is, indeed, a very active attempt to get the British cruiser *Princess Royal* ready for launching by the highest tide in April, as if this is not done there may be a difficulty in getting her off until the early autumn. The vessel has made considerable progress since the settlement of the lock-out, and there is a great army of men now employed on her, and much overtime has been found necessary in order to expedite the work to be done before the vessel goes round to the Buccleuch Dock to receive her engines, boilers and general fitments, which are practically ready to be lifted in. The effect caused by a lock-out of men for three months can scarcely be understood in the case of a huge vessel like this, which, when she was ordered, it was on the condition that she should be delivered to the Admiralty in two years. In the meantime almost all the materiul required has been delivered and is ready to be worked into the ship, with all the great facilities which this up-to-date

[illegible] of the [illegible] disposed. The shipyard in the evenings is almost as busy as in the daytime, as electric light is being used to get on with the work. It is believed that by the end of March the vessel will be ready for her cradle. When she is launched the engineers will be as busy as the shipbuilders are busy now, and the shipbuilders will then be at liberty to get on to other important work which is now getting ready for them.

The Japanese Battleship Cruiser.—Although this order is only in its initial stages, a deal of work has already been accomplished, and the vessel is gradually lifting herself from her keel plates. This is a very important order for Messrs. Vickers, because they have not only to build the ship, but to make her engines and all auxiliary machinery, together with her armour and guns. The contract approximates at two-and-a-half-millions of money, and will afford a great deal of employment, not only for the Barrow works, but for Sheffield and for Erith as well. There is probably no other firm in the world that could tackle such a job from its own absolute resources.

Australian Submarines.—It is officially intimated that the Australian Commonwealth has ordered from Messrs. Vickers, Sons & Maxim, two submarines in connection with the defence scheme of the Commonwealth. Messrs. Vickers are the only firm in the country that build submarines. A few have been built at the Chatham Dockyard from Messrs. Vickers' plans, and they have all been engined by the Barrow firm, which possesses the Holland patent, and in the experience gained by the construction of so many submarines for the British Navy, it is claimed that these sub-aqueous vessels are the finest in the world. In the beginning of the month there was an accident at the Barrow yard in connection with the test of one of the heavy oil-engines which are now used as the propelling agency in these vessels. It is necessary to work with a considerable air-pressure, and although there was nothing being done with heavy oil, the pipe conveying this pressure burst, and Mr. Hamilton Gordon, who was one of the managers in this department, was killed almost on the spot. At the inquest a verdict of accidental death was returned. Mr. Hamilton Gordon, who was an engineer of great promise, was a collateral descendant of the great Earl of Aberdeen, who was Prime Minister in the days of the Crimean War.

British Submarines.—Messrs. Vickers' firm are already very busy with submarines for the British Admiralty. It is understood they have five of the "D" class now under course of construction. It is difficult to know what is being done in this department, as the Admiralty insist on the greatest secrecy being observed, which fact is generally respected by all Barrovians. Occasionally one of these interesting vessels is launched, and for a few days is the subject of considerable interest, but nothing can be seen beyond the turtle deck, as all the important features are within the skin of the ship.

The Naval Airship.—It is expected this vessel will be launched in the course of about six weeks. She is practically ready to take her first flight but she will have to wait until it is light early in the morning, and then she will probably sail away, not to return to Barrow unless there is an accident, which the builders are doing all they can to take precautions against. Very great secrecy has been observed in connection with the construction of this airship, but it is now definitely known that she is 512 feet in length and 48 feet in width. Her outer envelope is sprinkled with aluminium dressing so that when she is in the air she will not be very clearly seen. She will present the appearance of a huge silver cigar. Her means of floating are supplied by eighteen gas bags filled with hydrogen. Her fans will be driven by two propelling motors with their large propellers, which have been manufactured by Messrs. The Wolseley Motor Car Co., Ltd. This is a firm that is owned by Messrs. Vickers' Co. She has been built under the superintendence of Capt. Murray F. Sueter, R.N., and when good weather comes along she will have exhaustive trials. It is expected that another airship will be built for the Admiralty so soon as the special shed in which No. 1 has been built is vacated by this vessel.

Engineering.—A very large programme of work is proceeding in the engineering works of Messrs. Vickers' Co. at Barrow. There was probably never so much work in hand at one time, and it is likely to be added to, not only in the marine, but in the gun-mounting department.

BELFAST.

(From our Own Correspondent.)

THE prosperous condition of the shipbuilding trade in Belfast has brought about the inevitable result of a demand for a rise of wages in several branches of the trade. The first body of men to have their claims granted are the carpenters, who are to receive an advance of one halfpenny per hour, the increase to take effect from 2nd March. No doubt other rises will be conceded in various departments in the near future. Wages in Belfast are at present, all round, pretty high, and, unfortunately, there is practically no such thing nowadays as reducing wages in bad times—the working man very conveniently turns his blind eye upon that aspect of the case. It is to be hoped, therefore, that the existing prosperity will continue for a long time to come.

Messrs. Harland & Wolff.—There is at present a great air of activity about the Queen's Island, and, what is better still, there is every prospect of this satisfactory state of affairs extending over a considerable period. The fitting-out of the *Olympic* is proceeding rapidly, and the launch of her sister-ship, the *Titanic*, is beginning to be looked forward to with interest. The Hamburg-America Company's new steamer *Bayern* has just been completed and sent to sea. She is a vessel of 8,250 gross tonnage, and is a sister-ship of the *Sachsen*, built a short time since for the same Company. These vessels have accommodation for a few passengers, but are primarily intended for cargo carrying, for which they have large capacity. Within the next few days the triple-screw Aberdeen liner *Demosthenes* will be launched from the south end of the Queen's Island. A famous Belfast-built liner was recently disposed of to Turkish buyers for, it is stated, £20,000. This is the Dominion liner *Ottawa*, better remembered as the old White Star liner *Germanic*, which was for so many years a great favourite on the Liverpool-New York passenger service. She was built by Messrs. Harland in 1874, and came to Belfast in 1895 to receive new engines and boilers.

Messrs. Workman, Clark & Co.—This firm have a big lot of work on hand, which ensures for them a long busy spell. They have two vessels nearly ready for sea—the Holt liner *Anchises*, and Messrs. Elder & Fyffes' new fruit steamer *Aracataca*. Another steamer, named *Neleus*, was launched by them on 31st January for the Blue Funnel Line, making the twenty-eighth vessel built by Messrs. Workman, Clark and Co. for these owners. Now, to add to this number, they have recently received an order for two more steamers for Messrs. Holt & Co. They will be about 460 ft. long with a gross tonnage of about 6,700—similar vessels to the above-mentioned *Neleus*. It would seem almost unfamiliar to find this firm without either a Blue Funnel boat or a fruit steamer.

The Port.—The Harbour Commissioners' annual report indicates a very satisfactory state of affairs. The total nett registered tonnage cleared during 1910 was 109,634 tons in excess of the best previous record, the total tonnage cleared being 2,800,285 tons. Redeemable consolidated stock to the extent of £16,050 has been extinguished during the year, the outstanding amount of stock being reduced to £1,553,707 10s. The total capital subscription to the sinking fund with accumulated interest thereon up to 31st December, 1910, amounts to £133,527 3s. 2d. Works of a various nature, too numerous to mention here, have been, and are being, carried out—building, dredging, reclamation, etc.

MESSRS. THE CARBONIC ACID GAS, ICE & COLD STORAGE CO., LTD., at their works at Albion Parade, Gravesend, have been making good progress since they commenced operations a few months ago, and the independent analysis of the gas supplied shows that the care and attention given to the manufacture by the management have been justified in the results and orders are being increasingly received from a widening circle of customers.

MESSRS. DOULTON & CO., LTD., have been entrusted with the entire installation of sanitary appliances for the public conveniences for ladies and gentlemen at the approaching Scottish Historical Exhibition, Glasgow, and a thoroughly representative exhibit of their various manufactures will be made at the same exhibition.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Barao de Cameta.—On January 15th, this vessel, which has been designed by Messrs. James Pollock, Sons & Co., Ltd., 3, Lloyds Avenue, London, E.C., and built to the order of that firm, was successfully launched at Middlesbrough. She is intended for service on the Amazon River as a passenger and cargo steamer. The dimensions of this vessel are: Length, 165 ft. 6 in. by 33 ft. by 7 ft., and she is fitted with two sets of compound surface-condensing engines and classed at Lloyd's A1 for river purposes. Special features in the passenger accommodation have been designed by Messrs. Pollock. Ice-making plant, cold storage chamber and electric light, will assist to make the *Barao de Cameta* one of the finest vessels on that great river.

Montenegro.—On January 31st, the Amazon steamer *Montenegro* was launched, being the third boat of its kind built this winter by Messrs. Cammell, Laird & Co. These vessels are handsomely fitted up in teak and oak, and have dining-room accommodation for forty people. A novelty for this class of steamer is a bar and lounge on the upper deck amidships. These vessels are fitted with triple-expansion engines 13½ in. by 23 in. by 35 in. by 34 in. stroke, the boilers being suitable for burning inferior or wood fuel. The machinery has all been placed on board and the finishing touches made to the furnishings.

Sao Pedro.—This is the third vessel that Messrs. James Pollock, Sons & Co., Ltd., have launched for this year's service on the river Amazon. The dimensions of the *Sao Pedro* are: Length, 131 ft. by 25 ft. by 7 ft. She is of the three-deck type and is fitted with compound surface-condensing engines. Like practically all Pollock's vessels now, she is fitted with their patent stern frame which practically assures the anticipated good speed being obtained on the trial trip. The accommodation is provided on both main and promenade decks and contains a number of detailed fittings that will add largely to the comfort of the passengers. Ice-making plant and electric light will make the *Sao Pedro* one of the best commercial boats on the Amazon river.

Dorie.—On January 26th, Messrs. Richardson, Duck & Co. launched from their yard a steel screw steamer of the following dimensions:—Length overall, 355 ft.; breadth extreme, 49 ft.; depth moulded, 24 ft. 4 in.; tonnage, gross, about 3,200 tons; deadweight, about 5,500 tons. This vessel, which has been built to the order of Messrs. Burdick & Cook, of London, will class 100 A1 in Lloyd's Register, and has been built under special survey. She is of the single-deck type, and has a cargo poop, bridge amidships with accommodation for captain, officers, and engineers in steel houses on bridge-deck, and topgallant forecastle for crew. A cellular double bottom throughout, and forward and after-peak tanks are fitted for water ballast, and equipment includes large horizontal multitubular donkey boiler, six steam winches, steam-steering gear, steam windlass with quick warping ends, stockless anchors, and all modern improvements for facilitating loading and discharging. The engines, by Messrs. Blair & Co., Ltd., have cylinders 24 in., 40 in. and 65 in. by 42 in. stroke, steam being supplied by two single-ended boilers having a working pressure of 180 lbs. This makes the seventeenth steamer that has been built to the order of Messrs. Burdick & Cook. Their present fleet consists of ten steamers, nine of which have been built by Messrs. Richardson, Duck and Co., and all of which have been engined by Messrs. Blair & Co., Ltd.

Daksa.—On January 30th, there was launched from the shipyard of Messrs. John Readhead & Sons, Ltd., South Shields, a steel screw steamer, built to the order of The Navigazione a Vapore "Unione" of Dubrevnik. The vessel is of the following dimensions: 384 ft. by 51 ft. 6 in. by 26 ft. 8½ in., and is of the latest type of cargo carrier, with long bridge, poop and topgallant forecastle. In addition to the double bottom and large after-peak tank, a deep hold tank has been built amidships for an additional 1,000 tons of water ballast. The loading and discharging arrangements are very complete and include eight steam winches and eleven derricks to work the large hatchways, and grain shifting boards and feeders are fitted throughout to Board of Trade regulations. The engines and boilers have also been constructed by Messrs. John Readhead & Sons, Ltd., the cylinders being 30, 43 and 71 inches diameter by 48 in stroke, with three main boilers of 180 lbs. pressure. The vessel has been built to the highest class and under special survey during construction, of Lloyd's Register, and also of Austrian Veritas, and has also been constructed under the personal supervision of Captain Krunajevic.

Sandefjord.—On January 30th, there was launched on the Tyne one of the largest steamers yet built on the Isherwood system of longitudinal framing. The vessel has been constructed to the order of Mr. P. A. Gron, of Sandefjord, and is of the following dimensions:—Length over all, 452 ft.; breadth extreme, 58 ft. She is of the shelter-deck type, and is capable of carrying a total deadweight of 10,650 tons on a moderate draught of water. The steamer is intended for the iron ore trade between Wabana (Newfoundland) and Sydney (Cape Breton), for which purpose extremely large hatches with special hoppers are arranged. The double bottom extends the full length of the holds, and gives a large water-ballast capacity. The vessel has been built to special survey of the Norske Veritas and the requirements of the British Corporation. A steam windlass and steam-steering gear, ten powerful steam winches, ten derricks, and a complete outfit of cargo gear are provided. The propelling machinery, to be supplied by the North-Eastern Marine Engineering Company, Wallsend, is of the triple-expansion type, having cylinders 28½, 47 and 78 inches in diameter, with a stroke of 54 inches, steam being supplied from three boilers working at 180 lbs. pressure. The machinery will give the vessel a speed of 11½ knots per hour.

Amazon Steamer.—On January 31st, there was launched at Birkenhead a new steamer which has been constructed for service on the River Amazon. The vessel has been built to the order of Señor Carlos Montenegro, of Manaos, Brazil. Her dimensions are 159 feet by 32 feet by 10 feet, and she has been built to Lloyd's highest class for river purposes. The machinery, of sufficient power to drive her about 11 knots loaded, consists of triple-expansion engines, having cylinders 13½, 23 and 35 inches, with 24-inch stroke, and multitubular boiler constructed to burn wood or inferior fuel.

Arabien.—On January 31st, the latest addition to the fleet of Det Ostasiatiske Kompagni, of Copenhagen, was launched from the Neptune Works, Newcastle-on-Tyne, of Messrs. Swan, Hunter & Wigham-Richardson, Ltd., in the presence of a large company of visitors. The steamer is intended for service between the Far East and Europe. She is 385 feet in length by 53 feet beam, and is designed to carry 8,200 tons deadweight. She is being built to attain the highest class in Lloyd's Register, and will be in all respects a cargo vessel of the best type. The propelling machinery, constructed by the builders, consists of a set of triple-expansion engines, supplied with steam by four single-ended boilers. The auxiliary machinery is of the most improved description, and the arrangements for working the vessel and her cargo are very complete.

Messina.—On January 31st, Messrs. The Northumberland Shipbuilding Co., Ltd., launched from their yard at Howdon-on-Tyne, the finely-moulded steamer *Messina*, which has been built to the order of Messrs. Furness, Withy & Co., Ltd., West Hartlepool. The vessel is 390 ft. long by 49 ft. beam by 29 ft. deep, and has been built under special survey to the highest class at Lloyd's. She is fitted with long bridge, long poop, topgallant forecastle, the accommodation, which is very ample, being placed in steel houses on the bridge deck. The 'tween decks are lofty and so arranged that cattle, troops or emigrants may be carried if necessary. Very special attention has been paid to the loading and discharging gear, and a complete outfit for the rapid handling of cargoes arranged for, consisting of nine steam winches by Messrs. Clarke, Chapman & Co., Ltd., Gateshead-on-Tyne, a large number of cargo derricks and steam windlass by Messrs. Emerson, Walker & Thompson Bros., Dunston-on-Tyne. She is fitted with the usual water-ballast arrangements for light passages. The machinery will be supplied by Messrs. Richardsons, Westgarth & Co., Ltd., Sunderland, consisting of engines with cylinders 25 in., 41 in., 69 in. by 48 in. stroke, three large steel boilers with 180 lbs. pressure. This vessel will carry about 7,500 tons on a light draught and steam about 10 knots loaded at sea.

Tellus. On January 31st, Messrs. Wm. Doxford & Sons Ltd., launched from their yard at Pallion, Sunderland, a large shelter-deck vessel built to the order of Wilh. Wilhelmsen, Esq., of Tönsberg, for whom the firm have previously constructed several vessels, and for whom they have now in hand a duplicate of the *Tellus*. The dimensions are :—Length, 465 ft. ; breadth, 60 ft. ; moulded depth, 37½ ft. The deadweight of 12,500 tons is carried on a moderate draught. Messrs. Doxford have supplied the engines and boilers. The classification is with the British Corporation and Norwegian Veritas. Messrs. Wailes, Dove & Co.'s " Bitumastic " enamel was applied to wing ballast tanks and bunkers.

Hockwold.—On January 31st, there was launched from the shipbuilding and repairing establishment of Messrs. S. P. Austin & Son, Ltd., the steel screw steamer *Hockwold*, of 2,200 tons deadweight capacity, which has been built to the order of Messrs. Wm. Cory & Son, Ltd., of London, and is the twenty-second vessel constructed for the same owners. She will be classed 100 A1 in Lloyd's Register, under special survey ; large water-ballast capacity is provided and there are large hatchways specially adapted for the owner's coal trade. The machinery will be supplied by Messrs. The North-Eastern Marine Engineering Co., Ltd., Sunderland, and all the auxiliary machinery is by first-class makers. Messrs. Wailes, Dove & Co.'s " Bitumastic " covering was applied to tank top in boiler-room. A Cochran (Annan) donkey boiler with patent seamless furnace has been supplied and fitted.

Burmese Prince.—On January 31st, the s.s. *Burmese Prince* was successfully launched from the shipyard of Messrs. Short Brothers, Ltd., at Pallion, Sunderland. She is built to the order of James Knott, Esq., for the Prince Line, Ltd., Newcastle, and her leading dimensions are :—Length, 410 ft. ; beam, 54 ft. 4 in. ; depth moulded, 28 ft. 1 in. Taking Lloyd's highest class, the vessel has complete shelter-deck, with upper and main decks, and is divided by six watertight bulkheads. Water-ballast is provided throughout the double bottom, in fore and after peaks and in a large chamber tank to height of main deck, fitted just aft of engine-room. The decks are supported by strong girders below beams, with wide-spaced tube pillars at corners of hatches. The loading and discharging arrangements have received special attention, sixteen derricks being fitted on strong tables at masts, with crosstrees above and four derricks on posts, working from six large hatches. Twelve steam winches, steam windlass, ash hoist with shoot overboard, steam-steering gear fitted in engine-room, controlled from wheelhouse on upper flying bridge and connected by rods and chains to double-armed quadrant on rudder-head, are supplied, driven from a large multitubular donkey boiler fitted on upper deck. Hand-steering gear is fitted in house aft. Accommodation for twelve passengers with saloon artistically panelled in polished oak, bathrooms, pantry, etc., is fitted in large house on shelter-deck. Captain's room, chart-room and office are arranged in house above saloon house, with a wheelhouse above. The engineers and officers are berthed in houses alongside engine casing on shelter deck and the crew and petty officers in the after end of shelter deck. Steam heating and complete sanitary service are provided in accommodation. Electric light will be installed throughout the vessel. The propelling machinery will be fitted by Messrs. George Clark, Ltd., and consists of triple-expansion engines with cylinders 27 in., 45 in. and 74 in. diameter and a stroke of 51 inches, taking steam from three large multitubular boilers of 180 lbs. pressure and fitted with Howden's forced draught. Messrs. Wailes, Dove & Co.'s " Bitumastic " enamel was applied to boiler-room tank and bunkers.

Lexie.—On January 31st, there was launched on the Wear a steel screw steamer, built to the order of Messrs. Alfred Laming & Co., of London. The dimensions are as follows :—Length, 363 ft. ; breadth, 50 ft., and depth, 25 ft. 11½ in. The vessel has been built under the special survey of Lloyd's Register to take their highest class. The engines will be supplied from Sunderland, the cylinders being 24½, 40 and 66 inches, with a stroke of 45 inches, supplied with steam from extra large boilers working at 180 lbs. pressure, and calculated to give a speed of 10 knots with an economical consumption of coal. Messrs. Wailes, Dove & Co.'s " Bitumastic " enamel was applied to boiler-room tank, and their " Bitumastic " [illegible] to tank top in boiler-room.

August.—On February 1st, Messrs. William Gray & Co., Ltd., launched the steel screw steamer *August*, which they have built to the order of Jacob Christensen, Esq., Bergen, Norway. She will take the highest class in the British Corporation Register, and is of the following dimensions, *viz* :—Length overall, 422 ft. 6 in. ; breadth, 54 ft. ; and depth, 26 ft. 11 in., with two decks laid, long bridge, poop and topgallant forecastle. The hull is built with deep bulb-angle frames, clear holds, cellular double bottom and large aft and fore-peak ballast tanks, ten steam winches exhausting into a winch condenser, steam-steering gear amidships, hand screw gear aft, patent direct steam windlass, shifting boards, stockless anchors, telescopic masts with fore and aft rig, boats on deck overhead and ventilation for the Eastern trade, electric light and all requirements for a first-class cargo steamer. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 26 in., 42 in., and 70 in. diameter, with a piston stroke of 48 in. and four steel boilers for a working pressure of 180 lbs. per square inch. Messrs. Wailes, Dove & Co.'s " Bitumastic " Enamel was applied to bunkers, tank under main and donkey-boilers, also ship's sides in way of saloons and deckhouses, and their " Bitumastic " covering to tank top in boiler-room.

Petrel.—On February 1st, Messrs. Osbourne, Graham & Co. launched from their yard at Hylton the steel screw steamer *Petrel*, which they have specially constructed for the Argentine and Brazilian coasting trade, to the order of Messrs. C. H. Pile & Co., of London. The vessel is 195 ft. by 36 ft. by 10 ft. 6 in. moulded, and has been designed to carry a large cargo on a very shallow draught. The accommodation for captain, officers and a few passengers has been tastefully fitted up in hardwood round the engine casing. The vessel is equipped with the latest appliances for quick and economical handling of cargo, and will meet the requirements of her trade in every way. Powerful engines are to be fitted aft in the vessel by Messrs. Richardsons, Westgarth & Co., Ltd., of Middlesbrough.

Amicus.—On February 1st, Messrs. Craig, Taylor & Co., Ltd., launched from their Thornaby shipbuilding yard, Thornaby-on-Tees, a handsomely modelled single-deck screw steamer of the following dimensions, *viz* :—368 ft. by 50 ft. by 25 ft. 8 in. moulded. She is built of steel to the highest class in Lloyd's Registry, under special survey, and has poop, bridge and topgallant forecastle ; water-ballast in double bottom fore and aft and in peaks. She is equipped with patent direct steam windlass with quick warping ends, steam-steering gear, six special steam winches, exhausting back to separate condenser in engine-room ; large multitubular donkey boiler of the marine type ; steel shifting boards in holds for carrying grain cargoes ; telescopic masts to Manchester Ship Canal requirements, double derricks, and latest improved gear fitted for rapid loading and discharging. She is also fitted up with special accommodation in the poop for apprentices and petty officers. Her engines have been constructed by Messrs. The North-Eastern Marine Engineering Co., Ltd., Sunderland, the cylinders being 25 in., 42 in., 68 in. by 45 in., with two large steel boilers working at 180 lbs. pressure, with large evaporator, feed heater, and patent steam ash hoist. The vessel has been built to the order of Messrs. W. H. Seager & Co., for Messrs. The Tempus Shipping Co., Ltd., of Cardiff, under the superintendence of Messrs. H. T. & F. G. Daniel, consulting engineers, Cardiff, and is the second steamer built by Messrs. Craig, Taylor & Co., Ltd., for the same firm.

Daphne.—On February 2nd, there was launched from the yard of the Sunderland Shipbuilding Co., Ltd., a steel screw steamer, length between perpendiculars, 257 ft. ; breadth extreme, 35 ft. and 17 ft. deep, having raised quarter-deck, bridge and topgallant forecastle, built to Bureau Veritas highest class, under special survey. The vessel will carry 2,100 tons deadweight, upon a light draught, and is fitted with water-ballast in cellular bottom and peak tanks. The saloon is amidships, and is fitted up in polished hardwoods, Four steam winches, steam-steering gear, and direct steam windlass are fitted. The engines are by Messrs. The North-Eastern Marine Engineering Co., Ltd., Sunderland, and have cylinders 19½ in., 32 in. and 53 in. by 36 in. stroke, steam being supplied by two large boilers, working at a pressure of 180 lbs. per square inch. The vessel has been built to the order of Messrs. G. Lamy & Co., of Caen, for whom the builders have previously constructed six steamers.

Beru. On February 2nd, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 115 ft. by 21 ft. 6 in. by 12 ft. 3 in. moulded. The vessel has been built to the order of Messrs. Baker and Grant, of Grimsby, and will be fitted with powerful triple-expansion engines by Messrs. C. D. Holmes & Co., Ltd., of Hull, and is replete with all the latest improvements for fishing purposes.

Gaythorn.—On February 4th, Messrs. W. Harkess & Son, Ltd., launched from their yard at Middlesbrough, the large hopper-barge *Gaythorn*, which has been built to the order of Messrs. Edmund Nuttall & Co., of Manchester, on whose contract at Messrs. Armstrong, Whitworth & Co.'s new yard at Walker-on-Tyne the barge will be employed. The vessel, which is exceptionally strong and well equipped, is built to Lloyd's 100 A1 class. She is designed to carry 1,500 tons on 12 ft. 6 in. draught and is amongst the largest craft of her kind in the kingdom. Her dimensions are :—Length, 180 ft. ; breadth, 36 ft. 6 in., and depth, 14 ft. moulded. It is interesting to note that the builders have launched this vessel and will deliver her complete on the Tyne within the contract time of twelve weeks from date of order, whilst it is expected that a sister vessel will be launched and delivered by them in the next fortnight, also within the contract time. Messrs. Harkess state that they have never once exceeded their contract dates during the past three years, an almost unique record, which they say is largely due to the splendid loyalty of their staff and workmen, with whom they have never had a single dispute during this period.

Walter Dammeyer.—On February 13th, there was launched from the yard of Messrs. The Sunderland Shipbuilding Co., Ltd., a steel screw steamer, length between perpendiculars, 205 ft. ; breadth extreme, 30 ft. 6 in. ; and 15 ft. deep ; having raised quarter-deck, bridge and topgallant forecastle. Built to Lloyd's highest class, under special survey, the vessel will carry 1,200 tons deadweight upon a light draught, and is fitted with water-ballast in cellular bottom and peak tanks. The saloon is amidships, and is fitted up in polished hardwoods, four steam winches, steam-steering gear, and direct steam windlass are fitted. The engines are by Messrs. The North-Eastern Marine Engineering Co., Ltd., Sunderland, and have cylinders 16½ in., 26 in. and 43 in. by 30 in. stroke, steam being supplied by two large boilers working at a pressure of 180 lbs. per square inch. The vessel has been built to the order of Messrs. The Lynn and Hamburg Steamship Co., Ltd., of King's Lynn, and during construction has been inspected by Geo. H. Strong, Esq., of Hull.

Auguszta Foherczegno.—On February 4th, Messrs. William Dobson & Co. launched from their shipbuilding yard at Walker the large steel screw steamer *Auguszta Foherczegno*, which they have built to the order of Messrs. The Hungarian Levant Steamship Co., of Budapest. The dimensions of the vessel are :—Length between perpendiculars, 378 ft. ; breadth, 53 ft. 3 ins. ; and depth moulded, 26 ft. 11 ins. The deadweight carrying capacity is over 7,500 tons on an exceptionally light draught of water. The steamer is constructed to the highest class at Lloyd's on the single-deck principle, with long bridge extending from foremast to mainmast. There are five large hatches, with ten steam winches. A large amount of water-ballast has been arranged for, there being a special deep tank in addition to the ordinary ballast in bottom and peaks. The propelling machinery is being constructed by Messrs. The North-Eastern Marine Engineering Co., Ltd., Wallsend, and is of the triple-expansion type, having cylinders 24 in., 39 in., 66 in. diameter by 45 in. stroke, with three large boilers to propel the vessel ten knots per hour. This is one of the largest vessels yet built for the Hungarian mercantile fleet.

Bra-Kar.—On February 14th, there was launched from the yard of Messrs. The Tyne Iron Shipbuilding Co., Ltd., Willington Quay-on-Tyne, a large steel screw steamer for the Fred. Olsen Line, of Christiania. The vessel is built to the highest class under the Norske Veritas classification and is of the following dimensions, *viz.*:—Length overall, about 400 ft. ; breadth extreme, 51 ft. ; depth moulded, 29 ft. 9 in. She is built with two complete decks laid with poop, bridge and forecastle, and has water-ballast fitted right fore and aft on the cellular system and is also fitted with all modern improvements for the rapid loading and discharging of cargo, including ten double-cylindered steam winches, direct-acting steam windlass, steam-steering gear by Messrs. John Lynn & Co., Ltd., with right and left screw gear aft. She is fitted with auxiliary winch condenser of large size, double derricks to all main cargo holds, derrick tables on masts with span outriggers at mast-heads, derrick posts on bridge for dealing with the cross bunker hatch and is fitted complete for carrying grain and has large electric light installation and steam heating arrangements to the accommodation, and is in all respects an exceptionally good example of the modern cargo steamer, carrying about 8,000 tons deadweight. The engines, which are to be supplied by Messrs. John Dickinson & Sons, Ltd., of Sunderland, are of the triple-expansion type, having cylinders 26 in., 42 in. and 71 in. by 48 in. stroke with three large single-ended boilers Working at 180 lbs. pressure.

LAUNCHES—Scotch.

Cap Ortegal.—On January 30th, a steel schooner-rigged steamer of about 5,030 tons gross, named *Cap Ortegal*, was launched at Port Glasgow, for Messrs. The Lyle Shipping Company. The port of registry is Glasgow. Messrs. Wailes, Dove & Co.'s " Bitumastic " enamel was applied to boiler and engine-room tanks, engine-room tank top, deep tank and bunkers, and their " Bitumastic " covering to boiler-room tank top.

Hildebrand.—On February 8th, there was launched on the Clyde a steamer named *Hildebrand*, which has been built to the order of the Booth Steamship Company, Liverpool. She is a twin-screw steamer of 10,000 tons gross, 440 feet in length, 54 feet in breadth moulded, and 38 feet in depth moulded to shelter deck. Accommodation is provided for 200 first-class and nearly 400 third-class passengers, while the vessel has large cargo-carrying capacity. Wireless telegraphy and equipment for submarine signalling have been provided. The machinery consists of twin sets of quadruple-expansion engines. Messrs. Wailes, Dove & Co.'s " Bitumastic " enamel was applied to the bunkers, insulated chambers and ship's sides in engine-room, and their " Bitumastic " covering to tank top in boiler-room.

Berwick Law.—A large steamer, named *Berwick Law*, has been recently launched at Scotstoun. She has been built under special survey to take the highest class at Lloyd's, and is to carry 8,300 tons of deadweight cargo. Her dimensions are :—Length, 404 ft. ; breadth, 53 ft. ; depth, 28 ft. 3 in. Messrs. Wailes, Dove & Co.'s " Bitumastic " covering was applied to tank top in boiler-room and their " Bitumastic " enamel to boiler-room tank and bunkers, and Messrs. Matthew Keenan & Co., Ltd., are engaged in covering all the boilers and pipes on board.

Bopple.—At Ardrossan there has been recently launched the screw steamer *Bopple*, built to the order of Messrs. Wilson, Hart & Co., Maryborough, Queensland. The vessel has been constructed to class 100 A1 at Lloyd's.

Edavana.—There has been recently launched on the Clyde a twin-screw steamer of 5,000 tons built to the order of Messrs. The British India Steam Navigation Company for their Eastern trade. The vessel measures 412 ft. in length, 52 ft. 6 in. in breadth, and 36 ft. in depth. She is fitted with accommodation for fifty first-class and forty second-class passengers and a large number of native passengers. The vessel was named *Edavana*. The machinery is designed to give a speed of 14 knots. A sister ship, the *Elephanta*, is now under construction.

Steam Trawler.—Messrs. Hall, Russell & Co., Ltd., Aberdeen, recently launched a trawler for Messrs. John Lewis & Sons, Ltd., Aberdeen. The dimensions are :—Length, 125 ft. ; breadth, 23 ft. ; and depth, 13 ft. 6 in. The vessel will be the largest trawler in Aberdeen. The engines will be supplied by the owners.

Ussa.—On February 15th, Messrs. The Clyde Shipbuilding and Engineering Co., Ltd., Port Glasgow, launched a steel screw steamer for the Baltic trade. The vessel is 295 ft. by 43 ft. by 29 ft. 6 in., and has been constructed to British Corporation highest class, under the superintendence of Mr. T. B. Stott, of Liverpool. The vessel was named *Ussa* by Mrs. T. B. Stott, and immediately after the launch was placed in the Company's dock to receive her machinery, which has also been constructed by the builders.

LAUNCH Irish.

Neleus.—On January 31st, shortly before high water, Messrs. Workman, Clark & Co., Ltd., Belfast, launched from their North Yard the steamer *Neleus*, built to the order of Messrs. Alfred Holt & Co., Liverpool. this being the twenty-eighth vessel constructed by them for Messrs. Holt & Co.'s Blue Funnel Line. The new vessel is a duplicate of the steamers *Perseus* and *Theseus* which were built by Messrs. Workman, Clark & Co. about three years ago, and, like them, is intended for service to the Far East. The *Neleus* is 457 ft. in length, with a gross tonnage of about 6,700, and has been constructed on the fore and aft girder principle, which ensures unobstructed cargo space in the holds and 'tween decks, thus facilitating the stowage of the largest class of goods. The cargo space is divided into four main compartments and two smaller ones, the latter being also arranged for use as water-ballast tanks. Each of these compartments is furnished with exceptionally large hatchways equipped with steam winches, derricks, and other appliances necessary for dealing expeditiously with a large general cargo. Accommodation for a number of saloon passengers is provided in state-rooms on the boat deck, and for steerage passengers in the forecastle, while the after end of the main deck is arranged for emigrants. Separate galleys and lavatories are provided for each class of passengers, and the ventilation of the accommodation throughout has received special attention. The propelling machinery consists of a set of triple-expansion engines complete with the necessary auxiliaries and supplied with steam from two single-ended multitubular boilers.

TRIAL TRIPS.

Elizabethville.—Recently the Elder-Dempster liner *Elizabethville* ran her speed trials on the Firth of Clyde. She has been built by Messrs. Alexander Stephen & Sons, of Govan, and has proceeded to Antwerp, where she will load for her maiden voyage to the West Coast of Africa. See November number for Launch.

Sachsen.—On January 21st, this large steel screw steamer, which has been built by Messrs. Harland & Wolff, Ltd., for the Hamburg-Amerika Line, went out on her trials, and subsequently left for Antwerp and Hamburg. The *Sachsen* is 470 ft. long, 58 ft. beam, and about 8,000 tons, and has been specially designed for the Eastern trade. She is of the three-deck type, with poop, bridge and forecastle, and is of very strong construction, built to the highest class of British Lloyd's, Germanischer Lloyd's, and to the requirements of the See-Berufsgenossenschaft, Hamburger Baupolizei and other German authorities. She has seven watertight bulkheads extending to the upper deck, steel decks and cellular double bottom extending right fore and aft. The new vessel has four steel pole masts, fore and aft schooner rig, and three derrick posts fitted with steel tubular derricks. There are in all twenty-one derricks, including 40-ton and 25-ton derricks, the facilities for working cargo being exceptionally good. The vessel has seven large cargo hatches, and the winches, windlass and steering gear are of the latest type. The ship has a complete installation of electric light, also Suez Canal electric projector. The *Sachsen* is fitted with quadruple-expansion engines on the "balanced" principle, also constructed by Messrs. Harland & Wolff, Ltd.

Arankola.—This vessel has just carried out a series of trials on the Clyde, when the machinery worked in a most satisfactory manner and a speed in excess of that contracted for was attained. The *Arankola* has been built and engined by Messrs. Workman, Clark & Co., Ltd., Belfast, to the order of Messrs. The British India Steam Navigation Co., Ltd., and is 404 feet in length, with a gross tonnage of over 4,000 tons. For further description of the vessel see December issue.

Mediterraneo.—On January 24th, the s.s. *Mediterraneo*, built by Messrs. William Doxford & Sons, Ltd., Sunderland, for the Societá Anonima di Navigazione a Vapore "Lussino" of Lussinpiccolo, ran a successful fully-loaded sea trial, when a mean speed of 11 knots was attained. For launch see January issue.

Batiscan.—On January 31st, the s.s. *Batiscan* left the Wear for her official trials. She has been built by Messrs. Short Brothers, Ltd., at Pallion, Sunderland, to the order of Messrs. E. F. & W. Roberts, of Liverpool. and is constructed on the Isherwood system, with single deck, poop, fore and aft bridge-deck and topgallant forecastle. Taking Lloyd's highest class, her leading dimensions are:—Length, 380 ft.; beam, 52 ft.; and depth moulded, 30 ft. 9 in.; and she carries a deadweight cargo of 7,850 tons on a moderate draught of water. The vessel has been specially designed to be chartered by the Dominion Coal and Iron Co., of Sidney, C.B., Canada, and is arranged with ten very wide hatches, with wing tanks, and with holds clear of all obstruction, so as to be entirely self-trimming. These hatches are fitted with steel hatch covers, hinged at one end of hatch so that all hatches can be ready for handling cargo within a few minutes of arrival at loading or discharging port. Water-ballast is carried in double bottom full width of ship, in fore and after peaks and in corner wing tanks along holds and machinery space, amounting in all to over 2,600 tons. This large quantity of ballast and its disposition will make the steamer safe and easy when running light. Accommodation for officers, with saloon panelled in oak, is provided in steel house on forward bridge deck, with captain's room, pilot's room and office in steel house above, and above this, captain's house, a teak chart and wheel-house with flying bridge is placed. The engineers are berthed in houses alongside of casing on after bridge deck, and crew and petty officers in forecastle. A sanitary service is installed throughout captain's, officers' and engineers' accommodation. Steam windlass, steam steering gear placed in engine-room, controlled from wheel-house and connected to quadrant by rods and cabins, hand-steering gear aft and steam ash hoist, are supplied. The propelling machinery has been fitted by Messrs. The North-Eastern Marine Engineering Co., Ltd., of Sunderland, and consists of triple-expansion engines with cylinders 26 in., 44 in., 73 in. diameter and a stroke of 48 in., driven by three large multitubular boilers, working at 180 lbs. pressure, and fitted with Howden's system of forced draught. The trials proved in every way satisfactory, a mean speed of 12½ knots being attained.

Argentine Transport.—On 4th February, the large steel screw steamer *Argentine Transport*, built to the order of Messrs. Furness, Withy & Co., Ltd., for Messrs. The Empire Transport Co., Ltd., London, proceeded on her trial trip in Hartlepool Bay. The trial was in every way satisfactory, a speed of 12 knots being maintained. This vessel, carrying 8,250 tons, was launched on January 14th, thus establishing a specially good record for finishing a boat of this size. For Launch see February issue.

Smiths Docks No. 2.—The new launch tug *Smiths Docks No. 2* is fitted with a 40 B.H.P. Bolinders two-cylinder direct reversible crude oil engine, and is intended as a shipyard tender at Middlesbrough for the Company from which she takes her name. The boat proved a great success on her recent trials, which were run on the Lower Reaches of the Thames; her speed exceeded the contract guarantee of 10½ miles an hour. Her consumption was under 2·9 imperial gallons of fuel oil per hour. The boat can be entirely navigated by one man; all the levers controlling the engine are brought into the steering house, which enables the steersman to manipulate his engine at will.

Endcliffe.—At the beginning of February the s.s. *Endcliffe*, built at Maryport and engined by Mr. James Ritchie, Glenavon Engine Works, Partick, ran trials on the Clyde. These consisted of a six hours' run at full power, and a speed test of six runs over the measured mile. The engines worked throughout satisfactorily, and the guaranteed speed was exceeded by over a quarter of a knot. The vessel was built to the order of Mr. Thomas Ward, of Sheffield, and is specially constructed for carrying heavy loads of scrap iron. For Launch see December, 1910, issue.

Rio Machado.—The twin-screw steamer *Rio Machado*, 580 tons gross, built by Messrs. Ritchie, Graham, and Milne, Whiteinch, for service on the Amazon, ran her trials on the Garloch recently in tempestuous weather. A speed of fully 13 miles per hour was obtained, being fully half a mile in excess of the contract speed. Engines of the triple-expansion type, with large return tube boiler, developing over 900 I.H.P., were supplied by Messrs. J. G. Kincaid & Co., Ltd., Greenock.

Armanistan. On February 10th the large steel screw steamer *Armanistan*, built by Messrs. Wm. Gray & Co., Ltd., for Messrs. Frank C. Strick & Co., Ltd., of London, was taken for her trial trip. The performance of ship and machinery was very satisfactory, a speed of 13·1 knots being obtained Mr. Archibald Walker, who has superintended the construction of the ship, represented the owners on the trial; Mr. James Innes, Lloyd's Registry; and Mr. Maurice S. Gibb, the builders. For Launch see February issue.

Bayern.—On February 11th, the *Bayern*, a large steel screw steamer, which has been built by Messrs. Harland and Wolff, Ltd., for the Hamburg-Amerika Line, went out on her trials, and subsequently left for Antwerp and Hamburg. The *Bayern*, which is a sister-ship to the *Sachsen*, built recently for the same firm, is 470 ft. long, 58 ft. beam, and about 8,000 tons, and has been specially designed for the Eastern trade. She is of the three-deck type, with poop, bridge and forecastle, and is of very strong construction, built to the highest class of British Lloyd's, Germanischer Lloyd's and to the requirements of the See-Berufsgenossenschaft, Hamburger Baupolizei and other German authorities. She has seven water-tight bulkheads, extending to the upper deck, steel decks and cellular double bottom extending right fore and aft. The new vessel has four steel pole masts, fore and aft schooner rig, and three derrick posts fitted with steel tubular derricks. There are in all twenty-one derricks, including 40-ton and 25-ton derricks, the facilities for working cargo being exceptionally good. The vessel has seven large cargo hatches, and the winches, windlass and steering gear are of the latest type. The ship has a complete installation of electric light, and also Suez Canal electric projector. The saloon is situated at the forward end of the bridge deck, the captain's and officers' quarters adjoin the saloon, and the engineers' quarters are at the after end of this deck. The crew's accommodation is under the forecastle deck. The *Bayern* is fitted with quadruple-expansion engines on the "balanced" principle, also constructed by Messrs. Harland and Wolff, Ltd

BOARD OF TRADE EXAMINATIONS.

1911.	Extra First Class.	
Feb. 2nd	—Black, W.	Ex 1C N. Shields
,, 2nd	—Gibson, W. S.	Ex 1C W. Hart'l
,, 2nd	—Kingdom, R.	Ex 1C South'ton
,, 2nd	Lawrance, A	Ex 1C Glasgow
,, 2nd	—Ray, D. R.	Ex 1C London
,, 2nd	—Rogers, W. P.	Ex 1C Falmouth
,, 2nd	—Sumner, G.	Ex 1C Liverpool
,, 2nd	—Turner, W.	Ex 1C London
,, 2nd	—Wrightson, T. H. ..	Ex 1C W.Hart'l

NOTE—1C denotes First Class: 2C Second Class.

January 19th, 1911.

Anderson, J. A. 1C Liverpool
Anderson, T. C. 2C N.Shields
Archibald, A. J. 1C London
Arthur, J. M. .. 1C Leith
Baker, F..... 1C N.Shields
Bebbington, G. 1C Liverpool
Bewley, J. .... 1C Liverpool
Binnie, A. .... 1C Leith
Brown, P. .... 2C Leith
Campbell, D. .. 1C Liverpool
Coutts, C. M... 1C Leith
Dalgleish, T. .. 1C Leith
Davidson, J. .. 1C W. Hart'l
Davies, W. H. 1C Cardiff
Drew, H..... 2C N Shields
Foster, J..... 2C Liverpool
Frogley, J. A.C. 2C London
Gilmour, R. .. 1C Leith
Griffiths, H. M. 2C Liverpool
Griffiths, J. R. 2C Liverpool
Griffiths, P .... 1C Cardiff
Harrower, P. M. 1C Glasgow
Hart, T. S. .... 2C W.Hart'l
Kerridge, G. V. 2C Liverpool
Kindred, P. T. 2C South'ton
Laird, J. ..... 1C Leith
Learmont, J. .. 1C Glasgow
M'Donald, J. .. 2C Glasgow
Mason, W. .... 1C W. Hart'l
Muscat, R. .... 1C London
Odgers, B. .... 2C London
Pass, J. C. .... 2C Liverpool
Patterson, H. G. 2C N.Shields
Pollock, J. .... 2C London
Raine, T..... 2C N.Shields
Ramsay, A..... 2C Glasgow
Ryan, D. J..... 2C Cardiff
Scougall, H. .. 2C Glasgow
Slade, A. F. .. 2C South'ton
Smith, F. G. B. 1C Cardiff
Spendley, N. Y. 2C N.Shields
Stewart, J. M. 1C London
Stott, W..... 2C Glasgow
Strang, D. R. . 2C London
Tomlinson, F.L. 2C W. Hart'l
Turnbull, W.M. 1C Liverpool
Vardy, W .... 2C N.Shields
Walker, A. C... 2C W. Hart'l
Watts, J. D. .. 1C Cardiff
White, J..... 1C Liverpool
Whytock, R. .. 2C Glasgow
Williamson, J.M. 2C Glasgow
Wilson, P. H .. 2C London
Windram, A. J. 2C London

January 26th

Adam, W. G. 2C Hull
Affleck, B. J. .. 2C Sunderl'd
Alcock, J..... 2C Liverpool
Bradshaw, V. B 2C Liverpool
Bruce, R. D. .. 2C London
Cowper, D. .... 1C N Shields
Fraser, W. .... 2C Aberdeen
Geddes, A. T... 1C London
Hagestadt, N.A. 2C Hull
Harries, J. R... 2C Liverpool
Harris, H. C... 1C Hull
Hendry, A. A. 2C Aberdeen
Hill, A. H. .... 1C Bristol
Holmes, R. F. 1C Hull
Innes, A. L. .. 1C Greenock
Kydd. A. ..... 2C Liverpool
MacDonald, J. 1C Greenock
Morrison, D. .. 1C Aberdeen
Notting, H. G. 1C London
Paterson, J. A. 1C Greenock
Patrick, R. .... 2C Greenock
Peters, W. R... 2C Liverpool
Philip, D. .... 2C Sunderl'd
Russell, H. ... 2C Sunderl'd
Sharp, H. B. .. 1C N Shields
Shotton, J. W 1C N.Shields
Simmons, G. C. 2C Liverpool
Spears, F. G. 1C Sunderl'd
Taylor, A. .... 2C Sunderl'd
Tavlor, H. A... 2C Liverpool
Taylor, H. B... 1C N Shields
Thyne, A. M... 2C Greenock
Wade, C. A. .. 1C Liverpool
Ward, W. H. .. 1C Liverpool
Wilcox, J. .... 2C Bristol
Wylie, S. W. .. 1C Liverpool

February 2nd.

Atkins, H. .... 2C N.Shields
Antoniades, P.G. 2C Leith
Ballantine, J. F. 2C Glasgow
Bond, R. H. .. 1C Cardiff
Bowler, J. F. .. 1C London
Brookes, J. W. 1C London
Croll, J. J. .... 1C Liverpool
Cumming, W... 2C Belfast
Crosbie, H. .... 2C Liverpool
Davis, J. H..... 1C Cardiff
Donaldson, G 1C N.Shields
Douglas, J. .... 1C Glasgow
Fallwell, A. E. 2C London
Flood, C. N. .. 2C Glasgow
Finnie, M. .... 2C Glasgow
Grey, J. H..... 1C N.Shields
Gyte, S. J. .... 2C Liverpool
Harvey, B .... 2C Liverpool
Hunter, J. .... 2C N.Shields
Hyslop, T. W. 2C N.Shields
Inwood, J. M... 1C London
Johnston, J. .. 1C Belfast
Lawrence, C.W 1C Falmouth
Livingstone, J 1C Glasgow
Lofthouse, H... 1C Liverpool
Macdonald, J... 1C London
MacKeller, T. S 1C Glasgow
M'Donald, W 1C London
M'Farlane, K 2C South'ton
M'Gilp, D. A... 2C Glasgow
M'Kersie, W. .. 2C Belfast
M'Kie, W A... 2C South'ton
Mills, P. ..... 1C Liverpool
Mitchell, J. M. 2C Glasgow
Morgan, E. B. 1C N Shields
Morton, D. R 1C Leith
Neligan, J. W. 1C London
Oliphant, E. J. 2C Cardiff
Owen, R. .... 1C Liverpool
Patersen, T. S. 2C Glasgow
Paterson, J. .. 2C Liverpool
Powell, W. .... 1C Cardiff
Redfern, N. K. 1C Liverpool
Rennie, C. A... 1C Liverpool
Richards, H. J. 2C Cardiff
Sawyer, H. L... 2C London
Sharp, J. ..... 2C Leith
Sillars, N. .... 1C Glasgow
Slatter, J. F. .. 1C Cardiff
Spence, A. F. .. 1C N.Shields
Swan, W. G. .. 1C Glasgow
Tattersall, H. .. 1C Liverpool
Tulloch, J. .... 2C Glasgow
Tweedy, W. .. 1C N Shields
Williams, M. O. 1C Liverpool
Wilson, D. W. 2C Leith
Wilson, H. M. 2C Leith
Wright, T. .... 1C Belfast
Wright, W. H. 2C N Shields

February 10th.

Anderson, E. .. 2C Liverpool
Barlow, G. .... 2C N Shields
Berry, W. A. .. 2C Liverpool
Brett, C. B..... 1C London
Brodie, S. .... 2C Liverpool
Dempster, W.A 1C Liverpool
Godfrey, R. G. 1C London
Gyte, D. .... 1C Liverpool
Hull, H. ..... 2C London
Jones, E. P .... 1C London
Lawrie, N. R... 2C Liverpool
Mahon, J. .... 1C Liverpool
Mellor, J. D. .. 2C Liverpool
Musto, R. W... 1C London
Phillips, R. P. 2C N.Shields
Robertson, W.H. 2C N Shields
Shields, G. R... 1C Liverpool
Spencer, J. D. 2C N.Shields
Thompson, G. 1C N.Shields
Thompson, W. 1C N.Shields
Turnbull, G. H. 2C N Shields

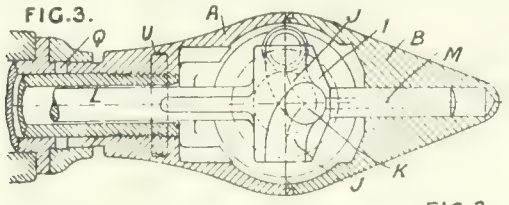
February 16th.

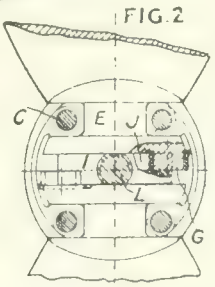
Agerskow, T. H. 2C Hull
Bargh, C. E. .. 1C Glasgow
Barr, T. ..... 2C Glasgow
Bowman, J. Y. 1C Greenock
Burbidge, L. .. 2C London
Clough, J. E. .. 2C N Shields
Crossley, J. B. 1C London
Crossling, W. F. 2C London
Esson, S. J..... 1C London
Gammon, R.W. 1C London
Hallatt, A. L .. 1C Hull
Heselton, T. A. 1C Hull
Hodge, J. R. .. 2C London
Humble, E. W. 2C N Shields
Kennedy, P. .. 2C Greenock
Kilpatrick, S. J. 2C Greenock
McArthur, A... 1C Greenock
McEwan, A. .. 2C N Shields
Mackay, W. .. 1C Glasgow
McNicol, A. .. 1C Glasgow
McStea, W. J. 1C N Shields
Mann, D..... 1C Dundee
Morrison, R. E. 1C Glasgow
Moses, S..... 2C N.Shields
Munro, R .... 2C Glasgow
Murray, L. C... 1C Hull
Noon, M ..... 2C N.Shields
Paxton, A. .... 2C Glasgow
Paxton, D. M. 2C Glasgow
Pybus, E. T. .. 2C Glasgow
Richards, W. D. 2C London
Robb, A. G. .. 1C Glasgow
Rookledge, F.O. 2C N.Shields
Sanderson, T. 2C Greenock
Shekyls, C. C. 2C London
Sloan, J. .... 1C Dublin
Smyth, S. W... 1C Greenock
Theobald, L. .. 1C Greenock
Ward, G. H. .. 2C London

The Marine Engineer and Naval Architect Patent Record.

Compiled by Messrs. F. P. Alexander & Son, Chartered Patent Agents, 306, High Holborn, London, W.C.

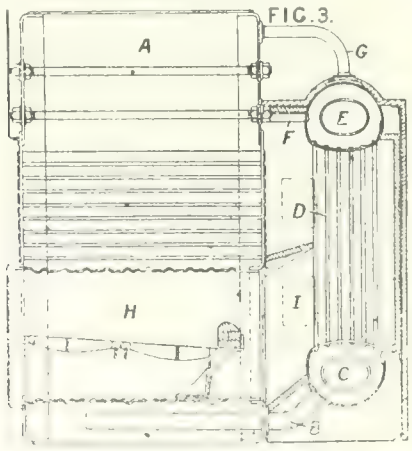
23,804. Screw propellers.—Comprises improvements in the operating-mechanism of feathering screw propellers. The boss is formed in two parts *a*, *b*, secured together by set-screws *c*, and providing journals *e* for the blades. Flanges on the inner portion of the blade shanks have pins *g*, formed integral with them and engaging slots *i* in a cam plate *i*, the longitudinal movement of which moves the blades from the ahead to the astern position. The slots in the cam-plate





are specially shaped so that the effective radius is constant. The outer edge is straight and radial for a short distance, and then curved into the centre as shown, terminating in a hole *k*. The cam-plate is guided by the operating-spindle *l* and a prolongation *m*, which slides in the cap. The boss is secured to the shaft by the partly plain and partly screwed portion, and by pins *u*, the plain portion being turned on the outside to fit a flange bolted to the stern-post, so that a recess Q is formed to receive lubricant and prevent corrosion of the shaft.

23,942. Steam-generators.—In the combustion chamber of a marine boiler *a*, two transverse drums *c*, *e* are fitted, which extend for the whole width of the boiler, and which are connected by straight tubes *d*. A pipe *b* con-



nects the lower drum *c* to the main boiler *a*; the upper drum *e* is connected by a series of tubes *f* and a pipe *g*. A baffle *i* deflects the flames from the furnace *h*, on to the lower parts of the tubes *d*. The drums *c*, *e* have flattened tube plates, and are of sufficient size for a man to enter to inspect and clean the tubes. The arrangement of drums and tubes may be applied to the combustion of a double-ended boiler.

24,019. Generating motive power for torpedoes, etc. In apparatus for generating motive fluid for torpedoes, etc., of the kind in which the motive power of compressed air is increased by burning liquid fuel therein and by spraying water into the hot combustion products, the fuel supply is made directly dependent upon the water supply, so that danger due to excessive temperatures consequent upon a stoppage of the supply of water is avoided. Water may be fed to the combustion chamber in the manner described in Specifications No. 3495, A.D. 1905, and No. 15,997, A.D. 1906, for feeding fuel, or as described in Specification No. 6081, A.D. 1907, for feeding both fuel and water. Water is forced from the tank *g*, Fig. 1, through a pipe *h* into the combustion chamber *c* by air taken by a pipe *f* from the connexion *d*

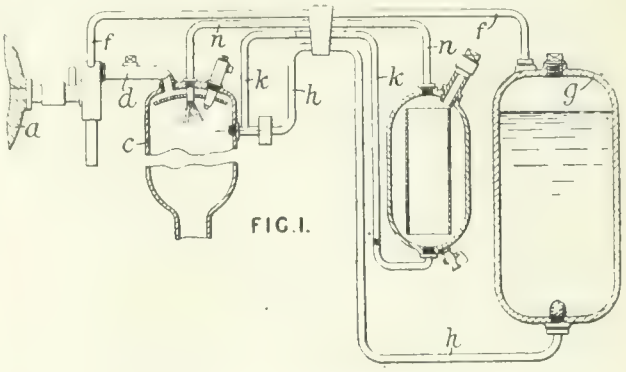


FIG.1.

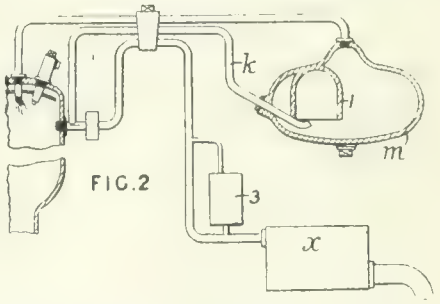


FIG.2

between the compressed-air reservoir *a* and the combustion chamber *c*. A pipe *k* connected to the water-supply pipe *h* conveys water to the bottom of the fuel tank *m*, thus displacing the fuel and forcing it through a pipe *n* into the combustion-chamber. A pump *x*, Fig. 2, may be used to force the water drawn, say, from the sea into the combustion-chamber. When sea-water is used, a solution of alkaline carbonate or hydroxide may be introduced into the combustion chamber, or a part of the water from the pump may be diverted through a vessel 3 containing an anti-corrosive liquid or a soluble solid. The pipe *k*, Fig. 2, opens beneath an inverted bell *l* or other air-entrapping device, thus preventing air from collecting at the top of the fuel tank. The fuel may be forced from the tank *m* by a bag into which the water pipe *k* opens, or the fuel may be placed in the bag and forced out by water supplied to the tank. The water enters the combustion chamber through a nozzle which discharges the water in a direction tangential to the surface of the chamber.

Institute of Marine Engineers.—The Annual Meeting of The Institute of Marine Engineers will be held on March 10th.

Liverpool Engineering Society.—The ninth ordinary meeting will be held on the 8th of March, when Mr. J. K. Catterson-Smith will read a paper entitled "The manufacture of turbo-electric generators and some of their applications to marine work."

The Marine Engineer

And Naval Architect.

LONDON, APRIL, 1911.

MARINE ENGINEERS' CERTIFICATES.

WE received in time for publication in our March issue a copy of the new regulations issued by the Board of Trade defining the conditions to be complied with by candidates for engineers' certificates, and in now commenting on the revised regulations, we consider these are in the right direction. The lengthened sea service is a good step and the encouragement given to attend a course of study for a portion of the time, or three months at least, is another good step. If the opportunity is taken advantage of the alternative should be productive of good, and help to promote a higher incentive towards preparing for examination than the mere anxiety to get enough material crammed into the mind for the purpose of passing. A systematic course of study interposed between the beginning of the stipulated sea service and the examination—or within two years of the latter—is calculated to add greatly to the status and value of the certificate, presuming that the course accepted by the Board of Trade is set at a sufficiently high minimum, and the approved college or school is conducted on systematic lines estimated to give practical men a grip of the fundamental principles on which practice is based, and sufficient knowledge of allied sciences to whet the appetite for more.

MARINE PROPULSION

THE development of marine propulsion is just now passing through a very interesting and important stage, and the results to be obtained in the near future from the experiments being carried out may possibly have a far-reaching effect in deciding changes of mechanical transmission of an extensive character. The reciprocating steam engine has practically maintained its position as the best all-round arrangement for the majority of ships, while the steam turbine of the type involving a high rate of speed has been demonstrated to be uneconomical for direct driving owing to the disparity which exists between the rate of revolution of the turbine and that found by long experience to be the best for the ordinary screw propeller, and further, the non-reversibility of most types of turbine. These features of the problem have been dealt with in one or two ways; for example, by the combination of reciprocating engines with an exhaust steam turbine, as installed on the *Laurentic*, or by the interposition of some form of transmission mechanism between the motive power and the propeller. It will be remembered that the S.S. *Vespasian* was fitted as an experiment with gearing between the turbine and the propeller as a guide to the arrangements to be fitted to two torpedo-boat destroyers at present building on the Clyde. Last month two small vessels were launched, one by Messrs. Maclaren Bros., of Dumbarton, which is to be fitted with electrical transmission gear between the engine and the propeller, and the other by Messrs. Eltringham, of South Shields, which is to be fitted with a system of hydraulic transmission between the two elements. It follows that the particular type of motive power element is not of much moment in either of these two experiments, as the problem is one of transmission only. Then again, a further line of development is in the direction of oil engines or gas engines applied on a large scale. Some large vessels are already in the course of construction which are to be propelled by oil engines, and we understand that a vessel of 7,000 tons is to be built and fitted with Diesel engines. With reference to oil, it seems to us that no marked extension in this direction is likely until the question of oil supply in large quantities all over the world has been determined, but the conditions obtaining with a gas engine are not the same, as the latter is practically in the same position as the steam engine from the standpoint of fuel. Of course, the broad point in the matter is what are the most economical means for transforming the heat energy of the fuel into mechanical energy at the propeller in such a way as to involve the greatest simplicity, the least risk of breakdown, the universal availability of fuel for the purpose, and the capacity of complying with all the necessary conditions for manœuvring the ship as far as modern requirements demand. It will be recognised that a single factor in the problem, such as the type of turbine or transmission gear, or the type of prime mover, whether steam, gas or oil-driven, will not settle the main question, as one is only a variant of the other, and so long as the simplicity of construction and easy handling of the reciprocating steam-engine hold the position they do to-day, we venture to think it will form the premier propulsive agent for the mercantile marine for some time to come. The great variety of the lines of development in the other systems of propulsion certainly tend to show difficulties of practical application of new arrangements rather than the gradual evolution of any new system of propulsion, as has been exemplified by the reciprocating steam engine and screw propeller for close on a century.

THE NAVY ESTIMATES

THE Navy Estimates for the financial year 1911-12 were published on March 9th, together with the explanatory memorandum of the First Lord of the Admiralty. The total sum asked for is the largest on record, even when allowance is made for

the fact that in 1904-5—the next most expensive year—nearly three and a half millions were devoted to naval works, the money for which was raised by loan. For the new financial year, £44,392,500 is taken in the Estimates, this figure being an increase over that of the previous year of £3,788,800. This increase, following on that of nearly 5½ millions in 1910-11, aroused some criticism, and a resolution declaring that the increase in expenditure was viewed with alarm, and ought to be diminished, was moved in the House of Commons by Mr. Murray Macdonald. Only fifty-six members voted for it, however, in a House of 332, and the general opinion appeared to be that, large as the Estimates were, they were no larger than national needs demanded. As Mr. Money said in a later debate, "no one who had spoken against the Estimates had shown in what particular they could be modified while securing the safety of the nation."

The shipbuilding programme for 1911-12 consists of five large armoured ships, three protected cruisers, one unarmoured cruiser, twenty destroyers, six submarines, and two river gunboats, with a depôt ship for destroyers and a hospital ship. Provision is made for the addition of 3000 to the *personnel* of the Fleet, or a similar number to that added last year. Indeed, the programme is almost identical with that of 1910-11, the chief point of difference so far as fighting ships are concerned being that only four cruisers are included instead of five last year and six the year before. The importance of a sufficiency of cruisers for the protection of our trade routes was emphasised during the debate on the Estimates by Mr. Eyres-Monsell, himself a naval officer, who submitted that the programme was totally inadequate in this respect. In reply, the First Lord had no difficulty in showing the House that at present we had an adequate number of cruisers of all kinds for the protection of the trade routes, the number being not far short of 100, besides thirty-four armoured cruisers of over 20 knots speed. As to the suggestion that other countries would arm their merchant ships, Mr. McKenna admitted that they claimed this right, but if ever it were exercised he considered we were fully equal to dealing with the emergency.

Dealing with the argument that the large ships of the "Dreadnought" type represent a great leap in cost, Mr. McKenna gave some interesting figures as to the comparative expenditure on these vessels and on their predecessors of the "King Edward" class, both for building and maintenance. The eight "Dreadnought" battleships already built cost £1,710,000 each, and represented an outlay sufficient to build nine "King Edwards." But the upkeep of the eight "Dreadnoughts" costs £50,000 a year less than the upkeep of nine "King Edwards." Thus for less cost the country gets eight much more effective ships, carrying eighty 12-in. guns and with a speed of 21 knots, instead of nine ships carrying only thirty-six 12-in. guns, and with a speed of 18½ knots. Of the many other topics discussed during the Navy Estimates debate, the most important was that of our standard of relative naval strength. Mr. Balfour pointed out that the two-power standard in its old integrity had been abandoned by the Government, which does not include the American Navy in its calculations; and the new standard of a fleet sufficient to meet any "reasonably probable combination" does not, like the old, afford the layman a simple method of estimating relative naval strength.

INSTITUTION OF NAVAL ARCHITECTS.

THE session for 1911 will commence, as previously stated, on April 5th at 11.30 a.m., in the Hall of the Royal Society of Arts, John Street, Adelphi, London, and will continue over the 6th and 7th of April. The programme of proceedings will be as follows:—Wednesday, April 5th, 11.30, (1) annual report of Council, (2) election of president, officers and Council, (3) election of new members, associate members, associates and students, (4) scrutineers appointed for next annual meeting, (5) alterations of rules required by Incorporation under Royal Charter, (6) address by the Chairman, and (7) presentation of the Institution Premium to Mr. T. B. Abell, R.C.N.C.

The papers, which appear to be of a very interesting nature, will then be read and discussed in the order and on the dates given. April 5th, "The problem of size in battleships," by Prof. J. J. Welch, M.Sc., member of Council; "Twelve months' experience with geared turbines in the cargo steamer *Vespasian*," by Hon. C. A. Parsons, C.B., etc., vice-president, and R. J. Walker, member; "The National experimental tank and its equipment," by G. S. Baker, member. There will be no evening meeting on this date. On Thursday, April 6th, morning meeting, the papers will be—"Diesel engines for sea-going vessels," by J. T. Milton, vice-president; "The influence of longitudinal distribution of weight on the bending moments of ships among waves," by F. H. Alexander, member; "Considerations affecting local strength calculations of ships," by J. Montgomerie, B.Sc. Evening meeting, 7.30, "The acceleration in front of a propeller," by R. E. Froude, LL.D., etc., hon. vice-president; "An investigation into the stresses in a screw propeller blade," by Eng.-Lieut. A. Turner, associate member. On Friday, April 7th, the papers will be—morning meeting, "Results of trials of the anti-rolling tanks at sea," by Dr. H. Frahm, member; "Steering-gear experiments on the turbine yacht *Albion*," by H. S. Hele-Shaw, LL.D., and F. Leigh Martineau; "Description of a stability and trim calculator," by S. B. Ralston; "General propositions and diagrams relating to the balancing of the four-cylinder marine engine," by C. E. Inglis, M.A. Evening meeting, 7.30—"The determination by photo-elastic methods of the distribution of stress in ships plating," by Prof. E. G. Coker, D.Sc.; "Some notes on a new design of merchant vessel," by M. Ballard.

In consequence of the lamented death of the late President of the Institution (the Earl Cawdor) the annual dinner will not be held this year.

The May issue of *The Marine Engineer and Naval Architect* will contain a full report of the proceedings, and many of the papers will be published *in extenso*.

Refrigerating Apparatus for Marine Transport.—Owing to the pressure on our space, the continuation of this series of articles has been omitted from this number, but will be continued later.

"Apexior."—Messrs. J. Dampney & Co., Ltd., had a highly successful exhibit of their various specialities at the exhibition at Buenos Ayres. Their "Apexior" is well known in the Argentine and a testimonial recently received from that Government speaks well as to the efficiency of "Apexior" in preventing the adhesion of hard scale and in arresting corrosive fittings in boilers.

THE FRENCH LINER "ROCHAMBEAU."

THE *Rochambeau* is the first liner of the French mercantile fleet to be driven by a combination of reciprocating and turbine engines, consequently her trials will be watched with keen interest. She is the first boat of her size and type built in France, designed and engined by a French firm, *viz.*, Chantiers et Ateliers de St. Nazaire-Penhouet, and was launched on the 2nd March from the Atlantic works of this Company, the launching weight being 7,000 tons. The vessel is intended for the Havre-New York route, and is of the "Chicago" improved type. Her main features are: Length between perpendiculars, 536′ 6″; breadth, 63′ 8″; depth from spar

deck level, 43′ 4″; displacement, 17,300 tons; I.H.P., 12,500 tons; speed, 17 knots. The *Rochambeau* is built of steel, and is divided into thirteen water-tight compartments. She is provided with a double bottom and will have five steel decks, and accommodation for 420 first and second-class passengers in addition to 1,450 steerage passengers. The main particulars of her machinery are: Diameter of the cylinders, 33·5″, 49″, 56″; stroke, 39″; R.P.M., 115; turbines—diameter of rotors, 68″; revolutions, 350; number of boilers, 9; diameter and length of boilers, 16′ 9″, 11′ 2″; pressure, 200lbs.

The owners and builders confidently anticipate low cost of running while obtaining most efficient power.

QUALIFICATIONS FOR MARINE ENGINEERS' CERTIFICATES.

THE new regulations issued by the Board of Trade regarding the sea service required from candidates for engineers' certificates of competency which appeared in the last month's number of the *Marine Engineer and Naval Architect* will be read with considerable interest by all those connected with the mercantile marine.

The changes foreshadowed will not take effect until January, 1915, thereby giving ample notice to apprentices and others who may intend to become sea-going engineers, and the chief alterations are as follows:—

(1) The qualifying sea service for both first and second-class certificates will be increased by one-half, becoming eighteen months instead of twelve as at present, in a foreign-going vessel, with an equivalent extension in the home trade.

(2) Time spent at a technical school approved by the Board of Trade for the training of marine engineers will, under certain conditions, be accepted in lieu of a portion, not exceeding one-sixth of the required sea service, that is, in the foreign trade up to a maximum of three months, the conditions named being that three months' attendance at the school shall count as equivalent to two at sea, that the Principal's certificate for continuous and regular attendance at all the approved classes and for satisfactory progress shall be produced and that the school time claimed shall have been within two years of application to be examined.

Very few practical engineers, except, perhaps, some of the juniors whose happy possession of their certificates will be somewhat postponed, will be likely to raise any objections to the increase of the qualifying sea service prescribed in paragraph (1).

The engine rooms of modern steamers, even of the ordinary tramp class, contain an amount of main and auxiliary machinery and appliances quite unknown in the vessels of thirty years ago, and it is fairly obvious that increased training and experience are necessary to obtain the knowledge required for the satisfactory working and upkeep of this increased mass of machinery. The ordinary apprentice has, moreover, in many cases, had no opportunity of seeing the engines of a large steamship at work until he goes to sea. He has therefore the whole of his duties in connection with their working to learn after he gets afloat, and when it is remembered that the possession of even a second-class certificate entitles the holder to go to sea in charge of the engines of a foreign-going vessel of less than one hundred nominal horse-power, it will probably be generally agreed that eighteen months is by no means an excessive time in which to gain the necessary knowledge, and that the increased service demanded will make for increased efficiency in those obtaining certificates.

With regard to the acceptance of technical school time in lieu of sea service provided for in paragraph (2), it may be said that when the proposals of the Board of Trade first became known, some misapprehension on this point existed, and this portion of the scheme did not in some quarters receive the same cordial endorsement that was extended to the remainder.

Time spent at technical schools approved by the Board has for some considerable time been accepted as part of the workshop qualification required from candidates for engineers' certificates, and it was thought that the intention was that attendance at the schools already approved should also count in lieu of sea service. This would undoubtedly have been open to several objections, but it now appears that this idea was a mistaken one. The establishments recognised under the new scheme will, it is stated, be schools "suitable for the training of *marine* engineers," and the approved course of study will be such as is fitted to their special needs and circumstances. Manifestly no manual instruction will be required, for the men will be already trained mechanics, and it is understood that having regard to the comparatively short time they are likely to devote to it, the course of study will be confined to the more elementary principles of mechanics and mechanical science, a good grounding in which would certainly be of great value to a young engineer.

A few public Technical Schools already exist specially designed to meet the wants of the seagoing man and when such schools are accepted by the Board of Trade the remission of sea service should encourage the attendance of young engineers at them, and also tend towards the establishment of other similar institutions, or of special marine departments in some of the existing Technical Schools in the larger ports.

Nearly all the engineers going up for certificates receive some preparation or coaching extending over several weeks, or it may be months, and an important part of the work of the approved marine school will probably be the preparation of candidates for examination, such as is already undertaken by the public marine schools referred to. It is, however, indicated in the notice published by the Board of Trade, that in order that attendance may be accepted in lieu of sea service, an approved course of general mathematical and scientific instruction must be taken, for which the Principal's certificate for regular attendance at all the approved classes must be produced, and it is understood that any special preparation for examination will be required to be additional to and distinct from the approved course. Coaching for examination, which is always liable to degenerate into mere cramming, will in the approved schools be supplemented by a wider range of definite scientific teaching, and as this will be accompanied by an increase of 25 % and upwards in the candidate's sea service, the nett result of the Board's proposals should be to promote a higher intelligence and efficiency among those who obtain certificates as marine engineers.

It is well known that the regulation permitting the substitution of attendance at approved Technical Schools for workshop service is not very largely taken advantage of by young men who intend to go to sea, but the present scheme appeals directly to the marine engineer, and will, it is hoped, supply him with an inducement to obtain increased technical education, and while the standard of practical training hitherto enforced will not only be fully maintained but increased, facilities will be given to the coming engineer to equip himself with a better knowledge and more scientific understanding of the machinery and appliances placed in his charge, on which the economical and successful working of the modern ship so greatly depends.

THE "HERCULES" AND "NEPTUNE."

THE *Hercules* and her sisters, the *Colossus* and *Neptune*, may be said to represent the final development of the type of which the *Dreadnought* was the precursor. With them the battleship carrying the standard dreadnought armament of ten 12 in. guns reaches its apotheosis in the British Navy, and the *Orion* and her sisters which follow them will be altogether of a larger and different type, carrying ten 13·5 in. guns, all arranged along the centre-line.

In making a comparison between the *Dreadnought*, the six ships of the "Bellerophon" and "St. Vincent" classes which followed her, and the *Hercules*, we find that two radical alterations have been made in the method of gun disposition. It will be remembered that the former ships carried their two amidship guns in the same cross-deck section with superstructure intervening so that they could not be brought to bear upon the opposite broadside, while the two after guns, being both on the same upper-deck level, had consequently rather limited arcs of fire, the concentration being six guns ahead and astern, and eight on either beam.

This arrangement may not seem ideal on paper when compared with that which has been introduced into the *Hercules*, but there is no doubt that in actual practice it is the best possible distribution that could have been selected at a time when data regarding the effects of super-firing and cross-deck firing of guns was lacking. The last ships mounting their big guns *en echelon* were the old "Inflexible" and "Colossus" classes, and the results obtained when these indulged in cross-deck firing showed that excessive strains were thrown upon the hull-side and deck structures. With modern weapons these would naturally be accentuated, and consequently no attempt was made to waste length, beam and displacement in the *Dreadnought* by giving her *en echelon* turrets, which, although adding to her value on paper, might prove of little value in practice.

Contemporaneously, the *Michigan* class carrying eight 12 in. pieces mounted in super-firing turrets were projected in the U.S.A., and their advent was watched with interest. American designers had previously experimented with double-decked turrets in the "Kearsarge" and "Georgia" classes, but with only qualified success—the strain on the mountings was too great. The *Michigan* was a bold attempt to obtain the maximum concentration of fire from eight guns on a minimum of length and displacement, and results soon justified expectations. By keeping the turrets close together so that the great force of the firing blast was expended in front of and not directly above the underneath turret, it was found that no great inconvenience was caused to the men below, while the arc of fire and non-interference in training was at a maximum. This having been demonstrated, and borne out by the preliminary experiments conducted in this country in connection with superfiring guns in the Brazilian battleships of the "Minas Geraes" class, the Admiralty felt justified in rearranging the gun positions of the "Neptune" class so that the after guns should have the increased all-round fire.

Meanwhile, cross-deck firing experiments had been made in the battle-cruisers of the "Invincible" type, whose amidships turrets were set slightly *en echelon*, so that a limited off-side bearing was possible. The design was not of the best as the turrets were not widely enough separated, but it was decided that by correcting this fault and strengthening the decks somewhat, the arrangement could be introduced into the *Neptune* with advantage.

So much for the factors that led to the evolution of the design. The measure of the success attained with the novel disposition of guns is not yet known. True, the gun trials are said to have been a success, but what firing tests—such as discharging all ten guns on the broadside simultaneously—were made, has not yet been made public, and the ship is now engaged upon an extensive cruise on which she will be put through exhaustive gun trials.

How much the results will affect future designs is an open question. The "all-centre-line" distribution of turrets, introduced by the designers of our earliest turret ships, resurrected by the U.S.A. for the "Michigans" and now re-introduced in the "Orion" class, will not be lightly abandoned unless it can be shown that cross-deck firing can be carried on without straining the ship less than has hitherto been the case.

Of course, the question naturally arises: Why should the Admiralty have dropped the *Neptune* design in favour of the "all-centre-line," without first testing the value of the former? Of course, such may not really have been the case. It is obvious that the next step onwards from the *Neptune* would be twelve guns, the extra couple being mounted on the forecastle, behind and firing over the foremost turret—the disposition in the new Argentine ships of 27,000 tons. Now the *Orion* is simply this with the one amidship turret deleted and the other brought into the centre-line; later and bigger "Orions" may carry twelve 13·5 in. guns, and should the *en echelon* prove a practical success there seems no reason to suppose that their guns may not be mounted on the same plan as are those in the Argentine ships. When all is said and done, the question is of no mean importance. The "all-centre-line" sacrifices end-on fire, and the value of axial concentration in the case of pursuit actions is not to be disregarded. Only by yawing about 30°, and consequently losing speed, could the "Orions" centre and after turrets be trained ahead, while the *Neptune* could bring eight guns to bear upon most points, without much manœuvring.

H M S *Hercules*

Before leaving the subject it may be of interest to note that besides the Argentine ships, the German *Von der Tann*, *Moltke* and, from all accounts, the latest battleships will have an *en echelon* arrangement amidships, as have also the Spanish "Espana" class, and according to latest reports, the four new Russian "Polavas." Following the U.S. lead, the Italians and Austrians have adopted the centre-line system, while the French and Japanese favour the "Dreadnought" plan of retaining wing turrets in the same cross-deck section.

Turning now to the other characteristics of the

Neptune, it will be noted that she differs considerably in outward appearance from the *Colossus* and *Hercules*, as may be seen from the plan of the former and illustration of the latter ship. The main difference lies in the rig, the later ships having one mast less, their tripod being abaft the fore funnel. This alteration has arisen through the introduction of a new system of "wireless" aerials which can be suspended from mast-head to ensign staff aft, whereas two masts were necessary to sustain the older pattern. The question of range-control has not, we believe, entered very much into the question. There will be a control-top the less, but armoured range-finding stations have been provided elsewhere which will be less exposed than those in the mast.

Another prominent feature of the new ships is the way the 4" 31-pounders are distributed. Sixteen of these are carried, and all are mounted in the superstructures, the turret-top positions having been discarded in favour of this more sheltered arrangement. In passing, it may be noted that the preceding "St. Vincent" class carried twenty 4", so that the anti-torpedo-boat armament has been reduced to below what was considered an efficient minimum, and is considerably lighter than that of any foreign warship under construction. At the same time, the *Hercules*' guns have such a high command and are so well spaced that their value is far greater than some of the heavier 4·7" and 5" batteries which are carried along the main decks of foreign contemporaries. Incidentally it may be noted that the *Hercules* carries no guns in the amidships superstructure, but has a somewhat longer superstructure forward to which these four guns have been shifted—a considerable gain in concentration.

The "Hercules" class are considerably better protected than previous "Dreadnoughts." The main belt is 12"-10" amidships tapering to 4" at the bow and stern and above this is a 9¾" belt which thins down to 2½" at the extremities. Enclosing the vitals is a 2¾" protective deck, while the big guns are behind 8" shields, the barbettes being 12". The secondary guns are unprotected.

Only three torpedo-tubes are carried, but these are for the new 21" torpedo—a far superior weapon to the former 18".

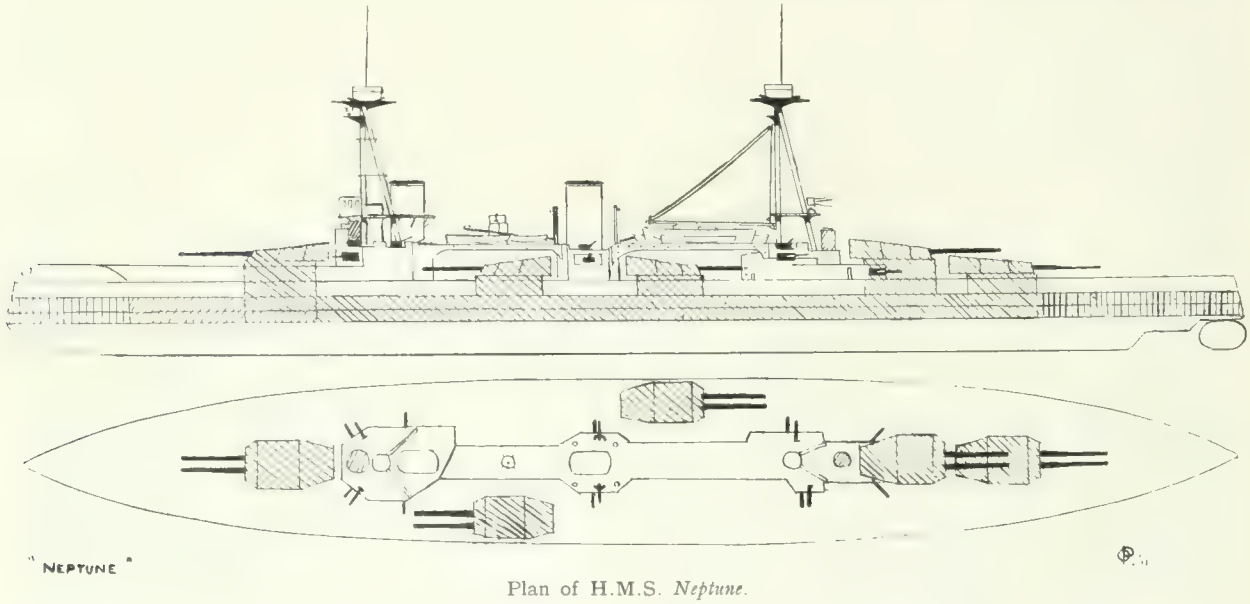
In the following table the *Hercules* is compared with foreign ships of contemporary design :—

		Displacement in tons.	I.H.P.	Speed	Armament	Torpedo tubes	Armour in inches A*	B*	C*	D*	Year of launch.
British	*Hercules*	20,250	25,000	21	10 12" 16 4"	3	12	2¾	0½	8-12	1910
U.S.A.	*Utah*	21,825	28,000	20·75	10 12" 16 5" 12 12 2"	2	11	½	5 to 8	12	1910
German	*Helgoland*	21,000	25,000	20·5	12 6" 16 3¼"	6	9½	4	8	11"	1909
Italian	*Dante Alighieri*	18,302	26,000	23	12 12" 18 4·7" 10 3"	3	10	2½	8	12"	1910
Brazil	*Sao Paulo*	19,200	24,500	21	12 12" 22 4·7"	4	9	2½	9	9	1909

*A—Water line belt. B—Protective deck. C—Lower deck belt. D—Big gun protection.

The comparative concentration of fire being as follows :—

	Broadside.	Ahead.	Astern.	Distribution.
Hercules	10 12"	6 12"	8 12"	Centre-line and *en echelon*.
Utah	10 12"	4 12"	4 12"	Centre-line.
Helgoland	8 12·2"	6 12·2"	6 12·2"	Two centre-line Four wing.
Dante Alighieri	12 12"	3 12"	3 12"	Centre-line in 3 gun turrets.
Sao Paulo	10 12"	8 12"	8 12"	Centre-line and two wing



Plan of H.M.S. *Neptune*.

from which it is evident that the British ship is far and away superior in all-round fire to all but the *Sao Paulo*.

The growth from the original *Dreadnought* upwards shows that although tonnage has greatly increased, the total cost is actually less!

	Displacement.	I.H.P.	Total cost.	Cost per ton.
Dreadnought	17,900	23,000	£1,813,100	£101·2
St Vincent	19,200	24,500	£1,754,615	£91·4
Neptune	19,900	25,000	£1,728,450	£86·8

All built at Portsmouth

The dimensions of the *Hercules* are: Length 540 feet (water line), beam 86 feet, draught 27 feet and her displacement 19,900 tons. The *Hercules* and *Colossus* are slightly heavier, their tonnage having been given as 20,250 tons. The *Neptune* was laid down at Portsmouth on January 19th, 1909, and launched on September 30th of the same year. At full speed she attained 22·7 knots and averaged nearly 22 knots for the eight hours. The *Colossus* laid down at Messrs. Scott's yard, Greenock, on July 19th, 1909, was

launched on April 9th in the following year, while the *Hercules* was commenced at Messrs. Palmers' Yard, Jarrow, on August 5th, 1909, and took the water on May 10th, 1910. Boilers and machinery were supplied by the builders, excepting in the case of the *Neptune*, when Messrs. Harland & Wolff were the contractors.

GAS-COAL AND OIL-ENGINED VESSELS.

PAPERS have been read during March on the subject of gas-coal and oil-engines before the Association of Engineers-in-Charge by Mr. W. A. Tookey (Gas Producers) and before the Institute of Marine Engineers by Mr. E. Shackleton, the latter of which, dealing with the marine type of engine is deservedly referred to more fully in other pages. The following list of marine engines made or in progress was given to show the advance being made up to the beginning of the year, since when several others have been placed :—Blohm & Voss, Hamburg, three vessels having engines varying in power from 1,000 to 2,000 h.p. Engines by M.A.N. 6,000 ton vessel having 2×850 h.p. engines for the Hamburg South American Line ; 6,000 ton vessel having Diesel engines by Carel Frères, Ghent ; 2,000 h.p. set for a ship by Messrs. Barclay, Curle & Co., Whiteinch ; 1,100 h.p. set of oil engines building by Messrs. Doxford and Sons, Sunderland ; The O.S. *Toiler* completing by Messrs. Swan, Hunter & Co., Newcastle ; 2×400 h.p. engines (M.A.N.) now installing in 3,000 tons sailing vessel ; one Dutch tug boat ; one Russian tank steamer, two engines ; one passenger tug, 200 h.p. ; four small boats, each having 2×250 h.p. Schneider Carels engines. The following motors have also been supplied by Messrs. Sulzer :—4×100 h.p., 2×150 h.p., 1×400 h.p., 2 motors each 400 h.p., (Italian mail steamer *Romagna*), 4×300 h.p., 2×800 h.p., 2×1,000 h.p. The solidified petrol which has been under evolution and testing for some time past seems now to be found suitable for lighting purposes, and possibly for gas motors designed to use petroleum in this form. Should it prove efficacious it will be better for storage and handling, as it occupies less space and gives more freedom from risk, besides being more cleanly. The projected racing match from the Clyde now announced to take place in June from the Holy Loch—a well-known rendezvous for yachting, will be an interesting event, and will give an impetus to motor-engined boats fit for sea-going conditions. The proposed course down the Firth of Clyde, along the Ayrshire coast and to the Isle of Man, will serve to try the mettle of the competitors. We note that several orders have been placed for small vessels and yachts during March to be fitted with gas engines, to use crude oils, while several enquiries are in the market for launches to suit coastal and river traffic, the lengths being about 32 to 45 ft. and the speed from 9 to 12 knots.

The area embraced by the oil fields of the world is a wide one, and it might be supposed that the cost of oil near to the producing fields would be considerably less than at parts more remote, yet we do not find this to be quite the case ; the markets of the world are so ruled by the force of circumstances that commodities in fair demand can be obtained at approximately the same price at ports far removed from the producing area, as within easy reach of it. Competition and invention, the hand-maid to necessity, are at work, and we have recently seen the oil-gas engine being developed to use crude residuum and shale oils, the latter being quoted at about 3d. per gallon. Enquiries have, within the past month, been made from Japan for engines of this crude-oil class, and it is anticipated that British makers will have a chance for orders, but with a nation like Japan repeat orders cannot be depended upon for longer time than it takes the Japanese workmen to master the work of imitation of the best type. The engines for the auxiliary-power yacht *Phantome* are under test and on the eve of being fitted in place. The trial results under way will probably affect the demand for vessels of a similar type. A small tug for service in the upper reaches of the Thames is in hand and will doubtless prove to be the forerunner of others fitted with gas engines. A word of caution seems to be necessary in connection with these engines, both for small and large power, and the advocates of the various types are not free from blame in the matter of glibly advising that anyone with ordinary or even less than ordinary intelligence can take charge of them. This is not so, and the wisest owner is he who sees to it that his property is entrusted to competent men and an adequate staff. It pays best in the long run, and is certainly preferable to the policy which is near akin to killing the goose that lays the golden eggs.

The new motor fire brigade boat *Gamma*, built to the order of the London County Council by Messrs. Thornycroft at their Southampton Works, has been tested by a demonstration during the month of March, and has satisfied the requirements. She is about 66 ft. long, draught about 3 ft. 9 in., speed about 10 knots. Twin screws, each driven by a paraffin motor of 80 B.H.P.

Messrs. Beardmore, after having carried out a series of tests with their crude (shale) oil reversible engines, are satisfied that they have reached a position which will enable them to build with confidence this class of engine for marine service. It is proposed to have an exhibit at the forthcoming Glasgow Exhibition to illustrate the points of this engine and its fitness for sea-going conditions.

We understand that the s.s. *Olympic* and s.s. *Titanic* are being fitted with a large number of the "Fournier" instruments for the purpose of showing various temperatures as required by the engineers. The tremendous size of these boats shows the wonderful adaptability of the "Fournier" instruments, by the fact that more than 12,000 ft. of tubing are used on each vessel to centralize the various dials on the starting platform of the engine-room. Literature concerning the "Fournier" instruments can be obtained by applying to Thermo and Pressure Instruments Ltd., at 60, Salusbury Road, Kilburn, London.

Large Marine Boiler Furnaces.—In connection with the boilers by Messrs. Neilson & Son, Glasgow, into which extra large plates have been worked, as noticed in the article elsewhere in this issue on "Large plates in marine boiler construction," it is of interest here to state that the furnaces fitted to these boilers are of the corrugated type, and are the longest of this type yet fitted in one piece to marine boilers in the Clyde district. They measure 10 ft. in length, by 3 ft. 9½ in. inside diameter, and were manufactured by Deighton's Patent Flue and Tube Co., Leeds. This Company whose works were specially laid out and the machinery designed for the manufacture of corrugated furnaces of the Deighton, Fox and other sections, have supplied, on more than one occasion, marine boiler furnaces up to 4 ft. 7½ in. outside diameter, and as many as twenty furnaces 5 ft. 1½ in. outside diameter, to the Lancashire & Yorkshire Railway Co., to be used as fire boxes for locomotive boilers.

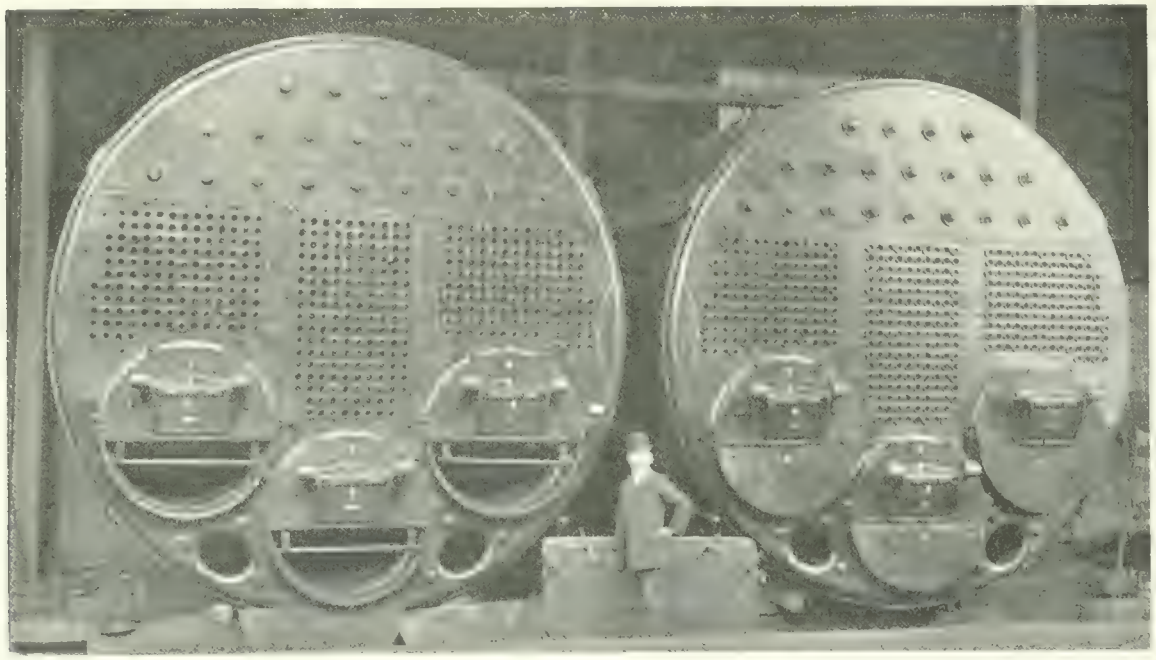
The Areo and Motor Exhibition, Olympia, March 24th to April 1st.—The extraordinarily rapid progress of the British Areo industry is well marked at this exhibition. Among the British machines two of very original design, suitable for military purposes, may be seen exhibited by the Areonautical Syndicate, Ltd. The Sanders Aeroplane Co. exhibit a passenger-carrying biplane with 60-80 h.p. E.N.V. motor. Messrs. C. Grahame-White & Co., Ltd., have an extensive stand and various other interesting exhibits are shown. The marine side is well represented, among whom we find the well-known firms of Messrs. John I. Thornycroft Co., Ltd., exhibiting a complete range of oil engines for marine and stationary purposes, in which the firm has specialized. On the stand is exhibited the handsome 30 ft. fast-cruising motor launch *Pixie*, designed specially for running in the Solent and the Channel. Messrs. J. W. Brooke and Co., of Lowestoft, have some very fine exhibits, including the 35 ft. racing cruiser with 120 h.p. "Brooke" motor, last year known as the *Ixia*, which successfully figured in the racing and turned out her 25½ knots. Actual engine models are on exhibit of 65 h.p. 6-cylinder "Brooke" motor, 45 h.p. 4-cylinder motor and others of 28 to 4 h.p. The collection of thirty cups and nine medals which have been won by "Brooke" motors in open competition are worth seeing. Other exhibits, all of which are of good class, include those of the Wolseley Tool & Motor Co., Ltd., Messrs. J. S. Saunders and Co., Ltd., of Cowes, the Parsons Motor Co., Ltd., and Ailsa Craig Motor Co., Ltd. Messrs. James Taylor's exhibit of river launches of nearly all types is of great interest.

LARGE PLATES IN MARINE BOILERMAKING.

THE progress which has of late years been made in boilermaking, and in the manufacture and handling of heavy plates, is well illustrated in some marine boilers which have recently been produced at the works of Messrs. James Neilson & Son, Ltd., Alma Boilerworks, Crownpoint Road, Glasgow, a view of two of which, as photographed in the works, we herewith give.

Within the memory of men who are not very much past middle-age the plates ordinarily used in the shells of boilers were only from three to four feet wide by seven or eight feet long, and weighed at most some seven or eight cwt. These were the days of small steam pressures, hand-riveting and many butts and seams in boiler shells. A strong contrast to this state of things is afforded by the size and weight of plates in the boilers now under notice, which well illustrates the development proceeding towards the almost total abolition of seams and riveting in boiler shells. The ideal of a rivetless boiler shell indeed has already practically been reached in boilers of small dimensions and in the drums for water-tube boilers, rolled and cylindrically completed directly from the solid steel bloom by special machinery, such as were recently supplied to Messrs. Yarrow and other engineers by Messrs. John Brown & Co., Ltd., Atlas Works, Sheffield.

The large plates referred to as having just been used by Messrs. Neilson & Son are 31 ft. 7 ins. long and of the unusual width of 12 ft. 5¼ ins. The boilers into which they were worked were 15 ft. diameter by 13 ft. long, built for a working pressure of 175 lbs. per square inch. The adoption of one plate of this width and length in each boiler not only dispensed with any middle circumferential seam, and enabled the shell to be made in two parts only—a thing which is now quite common—but also, and of more importance still to the company for whom the boilers were built, enabled the two necessary longitudinal seams to be arranged at the upper crowns of the boiler, clear of parts subject to variable contraction and expansion strain, and in positions readily accessible for repair. The two seams and straps will readily be seen on the upper part of our illustration. Although in the matter of superficies and weight the plates in question are the largest yet worked into boilers in the Glasgow district, being 1¼ in. in thickness and between nine and ten tons weight each, they are not the largest plates which have been used for boilers, as we understand that Messrs. J. Spencer & Sons, Ltd., Newburn, Newcastle-on-Tyne, from whose works the plates under notice were obtained, have supplied even heavier plates to some of the boilermakers on the Tyne, *viz.*, plates 33 ft. 10½ ins. long by 11 ft. 4½ ins. wide by $1\frac{17}{32}$ in. thick, which weighed over 11 tons each, and the area of which was 385 ft.



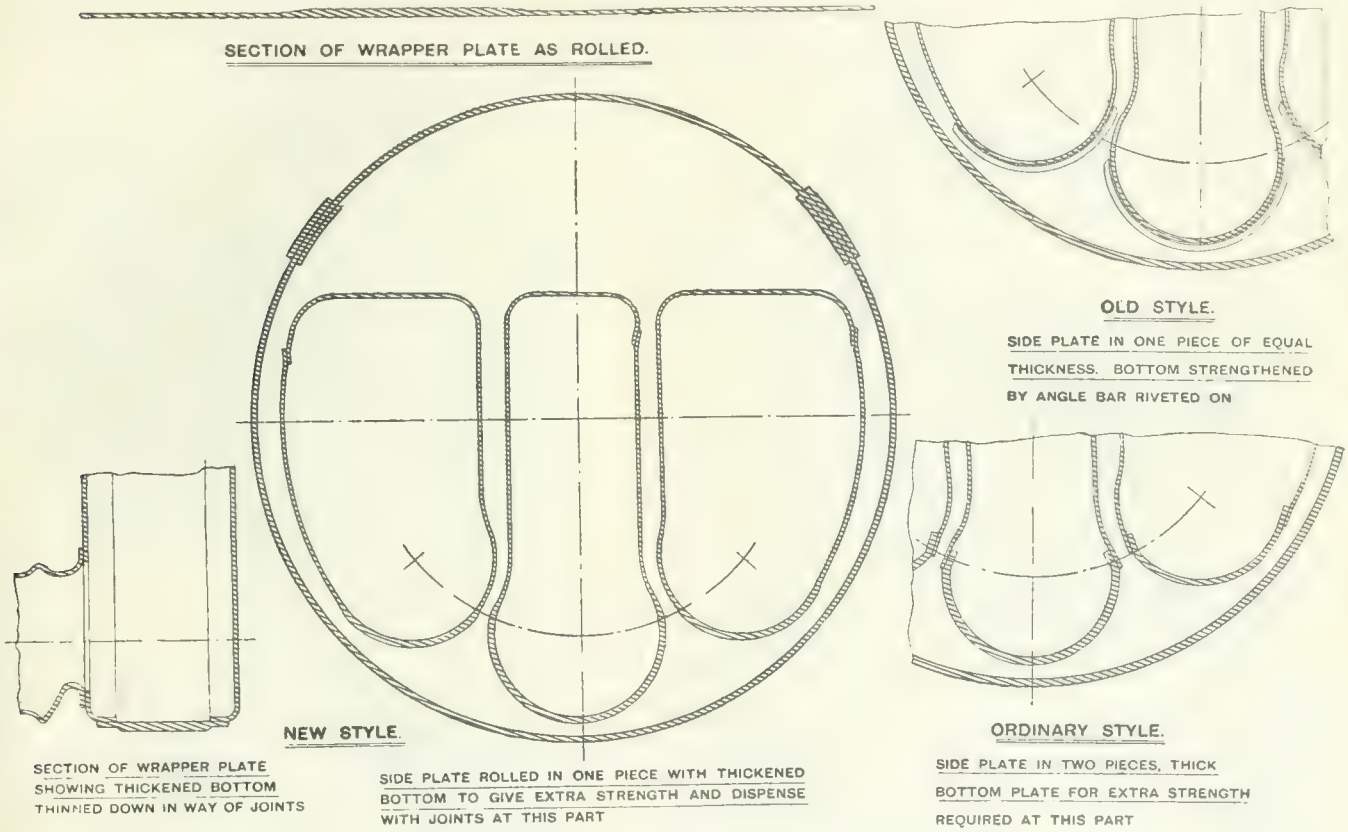
Boilers having shell mainly in one large plate, by Messrs. James Neilson & Sons, Ltd., Alma Boiler Works, Glasgow

Maximum superficies alone considered, much larger plates can, of course, be rolled at steelworks, and even ten years ago steelmakers were able to demonstrate the great capabilities of their plant in this respect.

In the machinery section of the Glasgow Exhibition of 1901, Messrs. David Colville & Sons, Motherwell, showed two steel plates, one of which was 72½ ft. long by 6 ft. 2 ins. wide by ⅞ in. thick, the other being 65 ft. long by 6 ft. 2 ins. wide by $\frac{15}{16}$ in. thick. In superficies the largest of these was 447 sq. ft., but the weight was only seven tons. At the Franco-British Exhibition in London in 1908 Messrs. J. Spencer & Sons exhibited a plate 39 ft. long by 12 ft.

10 ins. broad by 1 in. thick, the weight of which was 9 tons 10 cwts. and the superficies 500 ft. Boiler plates, we are given to understand, have been quoted for in the Clyde district of over 45 ft. long, 12 ft. broad and $1\frac{5}{16}$ in. thick, the area exceeding 550 sq. ft. and the weight over 14 tons. There is seemingly no finality to the possibilities in manufacturing large and heavy boiler plates. The limiting conditions are those concerned with the cost of production chiefly, and not of handling them in the boiler shops. Messrs. Neilson and Son and others using the larger plates affirm that the plates can be handled and bent and riveted with as great or even greater facility with modern tools as the smaller plates of thirty or forty years ago could be with the machinery then in vogue. Notwithstanding extra cost, it is significant that shipowners, and boilermakers as well, are found taking increasing advantage of the utmost capacity of steelmakers. As time goes on the extended use of plates of extreme sizes will naturally give steelmakers confidence in reducing the extra charges presently necessary.

In connection with that aspect of the general subject of boilermaking development having reference to the reduction of seams and riveting, it is worthy of note that Messrs. J. Spencer & Sons, Ltd., are now providing boilermakers with opportunity for further improvements. This is the provision of plates rolled to special section for use in the construction of combustion chambers. These are the "wrapper" plates, only one of which is required for the sides, top and bottom of the combustion chamber; and, having been rolled of varying thickness, they can be so bent or formed as to have the thicker portion at the bottom or more exposed part of the box, where extra strength is required, while the thinner portions form the sides and top. Only one single joint is thus required, and this may be placed near to the top, where it is free from the disturbing effect of expansion and contraction of the furnaces and of the more or less stagnant water at the bottom of the boiler below the furnace level. By this new method of construction the usual three-ply joints, necessitated by the use of separate thick and thin bottom and side plates, are entirely done away with, while the change from one thickness to the other being very gradual, no sharp or sudden variations of thickness occur at any part. It is well known that great trouble is frequently caused by leakage at the joints in the usual form of construction, but by the adoption of this improved method the trouble from this cause is entirely removed, while the life of the boiler may be considerably extended. The appearance of these special plates, and the manner in which they are worked into combustion chambers, will be gathered from the accompanying sketches, which also show the ordinary form of wrapper plates with thickening plates added. Messrs. J. Spencer & Sons, Ltd., who are the sole manufacturers under licence from the patentees, have supplied this special form of combustion-chamber plating to boilermakers in the principal engineering districts.


SECTION OF WRAPPER PLATE AS ROLLED.
OLD STYLE.
SIDE PLATE IN ONE PIECE OF EQUAL THICKNESS. BOTTOM STRENGTHENED BY ANGLE BAR RIVETED ON
NEW STYLE.
ORDINARY STYLE.
SECTION OF WRAPPER PLATE SHOWING THICKENED BOTTOM THINNED DOWN IN WAY OF JOINTS
SIDE PLATE ROLLED IN ONE PIECE WITH THICKENED BOTTOM TO GIVE EXTRA STRENGTH AND DISPENSE WITH JOINTS AT THIS PART
SIDE PLATE IN TWO PIECES, THICK BOTTOM PLATE FOR EXTRA STRENGTH REQUIRED AT THIS PART

Combustion Chamber Wrapper Plates—specially rolled.
Makers: Messrs. John Spencer & Sons, Ltd., Newburn, Newcastle-on-Tyne.

"BAMAG" MULTIPLE DRILL HEADS.

GREAT advance has been made from a labour-saving standpoint in the construction of machines for multiple drilling, but in most cases this has been effected by the design of special drilling machinery. Any compact adjunct for effecting the same purpose which can be applied to an ordinary drilling machine of standard manufacture should be received with satisfaction by the owners of ordinary drilling machines who desire to carry out multiple drilling operations.

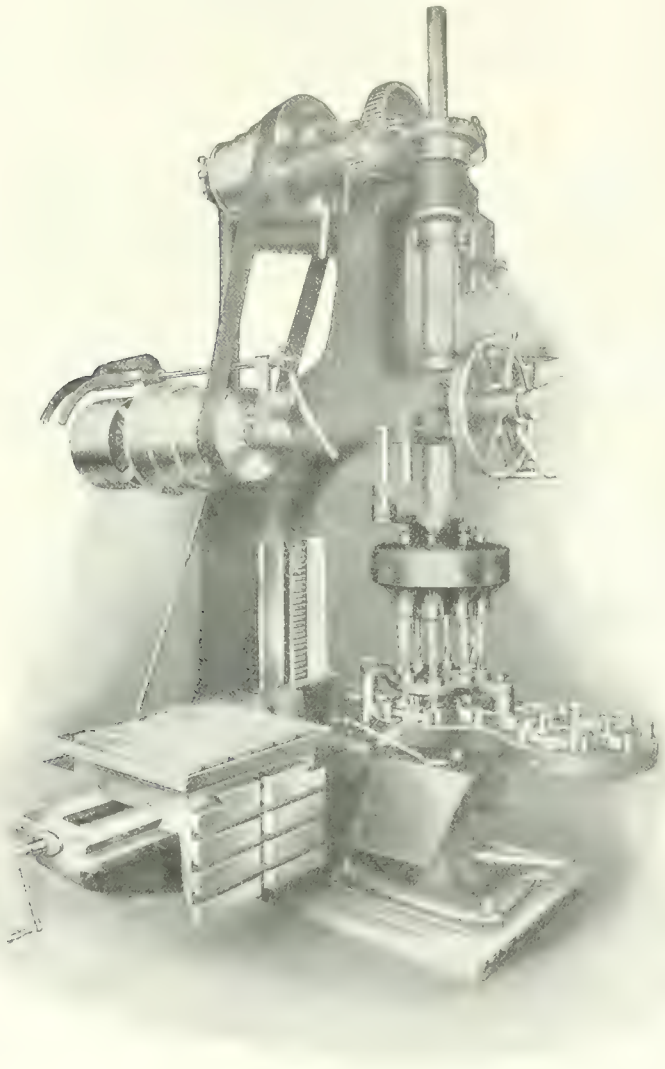


Fig 1.

An extremely ingenious self-contained device of this nature is now being put upon the market by Mr. O. N. Beck, of 11, Queen Victoria Street, London, E.C., which is claimed to fulfil some very useful functions. In the first place means of adjustment are provided which readily permit the setting of drills of unequal length to a uniform height of tool edge, and further, any desired pitch of holes within the range of the device can be effected within a very few minutes. It is further possible by using different tools in the various holders to perform several operations of a varied character consecutively without shifting the work from the machine.

In Figure 1 we illustrate a drilling machine of modern type, fitted with one of the "Bamag" multiple drill heads. The device is supported in the drilling spindle by means of a taper shank and is secured in position by a cotter. The drill head is provided with an arm in which is rigidly mounted a guide-rod extending in an upward direction and disposed with its axis parallel to the drilling spindle. This guide-rod slidingly engages with an adjustable bracket mounted in a boss on the frame of the drilling

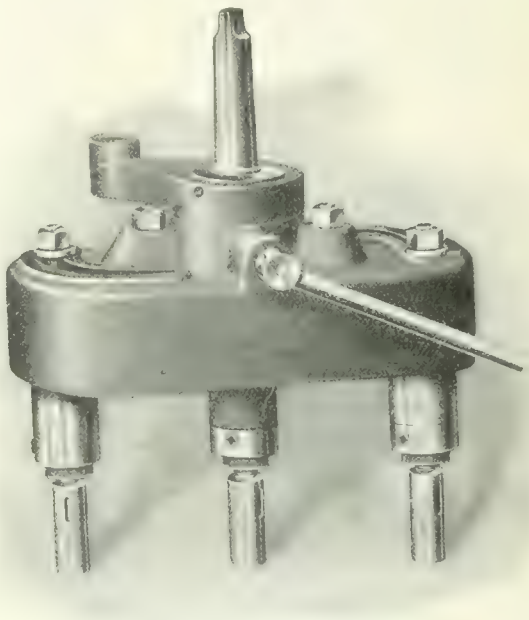


Fig 2.

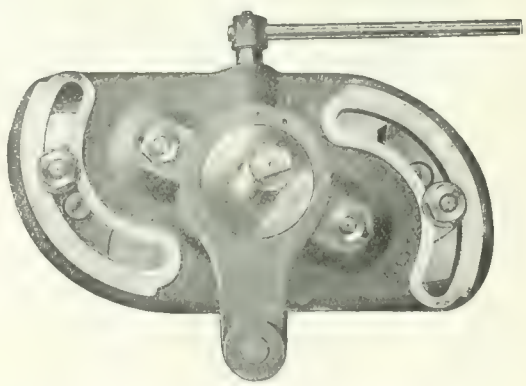


Fig 3.

machine and adapted to be held firmly in said boss by means of a set screw. This combined device prevents the drilling-head from revolving about its axis while at the same time permitting a sliding movement of the head in an axial direction. The drills are mounted in tapered chucks adapted to allow of each drill being adjusted vertically so as to get a uniform height of cutting-edge for the various drills. Within the drill-head is disposed a cog wheel, carried by the spindle having a taper shank, and this wheel gears with

pinions mounted upon each drilling spindle; in this type of head illustrated in Figure 1, the distance between the centres of each drill is constant.

Turning now to Figures 2 and 3, a form of drill-head is there illustrated in which there are a central spindle and two lateral spindles, the lateral spindles being capable of adjustment radially to and from the main spindle by means of epicyclic gearing disposed between the central spindle and the lateral spindles, the distance between the centres of the drills being adjusted by moving the lateral spindles round in a curved slot in relation to a graduated scale on the upper surface, and when so adjusted the position is maintained by tightening the clamping nuts. The drill-head can be revolved relative to the arm to any suitable position, and can be firmly clamped by means of a jamming screw fitted with cross handle.

In Figure 4 the central spindle is avoided and four spindles are provided at equi-distance from one another. In this case the same principle of adjustment from

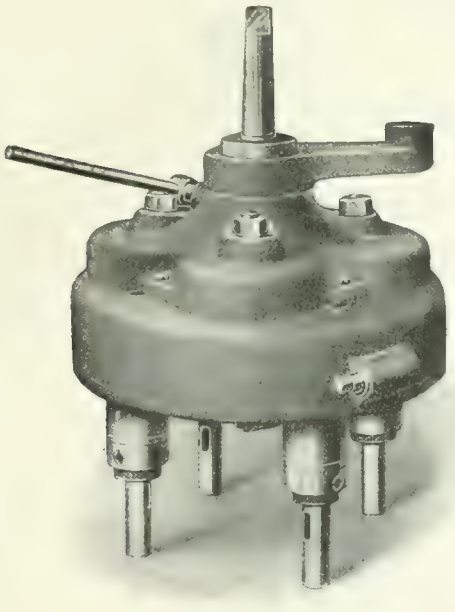


Fig 4

centre to centre is adopted as shown in Figure 3, but with the difference that the adjustment of all the four spindles is effected simultaneously by means of the small adjustment device shown at the right-hand side of the illustration. Ball bearings are used for supporting the main spindle in order to reduce friction as much as possible. To show the limits of adjustability with one of these drill-heads, six holes can be drilled simultaneously round a pitch circle of any diameter from $7\frac{1}{2}$" up to 13", or in other words with a pitch of holes of any distance between $3\frac{3}{4}$" to $6\frac{1}{2}$", or the drilling of holes in a straight line can be effected with pitches of from $3\frac{3}{4}$" to $6\frac{1}{2}$". With the drilling-heads shown in Figures 2 and 3 it is obvious that the pitch of holes on each side of the central spindle can be made to vary according to circumstances. Each form of the device appears to be of a substantial character and with special provision made for lubrication in each type, therefore no difficulty should be experienced in the operation of the drilling-head under ordinary working conditions.

SHIPPING REGISTRIES AND SHIP-BUILDING DEVELOPMENT.

THE twenty-first annual meeting of the British Corporation Registry of Shipping was held in Glasgow, on February 22nd; and the eleventh annual dinner of the Scottish staff of Lloyd's Register on March 11th, in St. Enoch's Hotel, Glasgow. At both gatherings interesting facts transpired as to the progress being made by both societies in various directions, and as to the satisfactory position which they increasingly hold in the estimation of shipbuilders, ship-owners and underwriters at home and abroad. Modern methods of ship construction, and the great possibilities which lie in the application of internal combustion engines to marine propulsion were interestingly touched upon in the course of the proceedings at both gatherings. Mr. Francis Henderson, at the British Corporation meeting, said that in spite of last year's lock-out, over 217,000 tons of shipping were completed during the twelve months to the classification of the Registry, while there were at present building in the United Kingdom and elsewhere, to their classification and rules, over 373,000 tons. Mr. Fred J. Stephen, chairman of the Technical Committee, said it was significant of the absorption of new ideas which characterized modern times that a preponderance of the shipbuilding work now in hand was being built on 3-ft. frame pitch, with stringerless sides, and on the open-floor, double-bottom systems of construction. The interesting feature of this development was the fact that the most conservative shipowners and shipbuilders had grasped the advantages of the simpler design, and had adopted it in every class of merchant ship, from tramp to liner. The work which had interested his committee most had been that in connection with internal combustion motors. The vessel named *Toiler*, built on the Tyne, and the first cargo vessel to be built in this country for propulsion by Diesel motors, went through satisfactory machinery trials during last summer. She was intended for service on the American lakes. There were already four other vessels to be built under British Corporation Survey in this country to have the same motive power. Mr. Thomas J. Dodd, principal surveyor to Lloyd's Register in the Glasgow district, presided at Lloyd's social meeting. Mr. Thomas Bell, of Messrs. John Brown & Co., Clydebank, in proposing "Lloyd's Register," said it was due to Lloyd's that the insurance of great mercantile shipping enterprises had ceased to be purely speculative, and had been placed on a sound, business-like basis. The General Committee had always adjusted their policy on broad-minded lines, and so they had been able to meet the changing demands of the world's trade. Mr. F. C. Gardner, chairman of the Glasgow Committee, said that Lloyd's had already classed sixty vessels built on the new Isherwood system of construction, and they had at present before them other matters of high moment. At the end of their last quarter, $87\frac{1}{2}$ per cent. of the tonnage building on the Clyde was intended for classification under their rules. Mr. John H. Heck, principal engineer-surveyor at Glasgow, referred to the new Cunarder placed at Clydebank, and gave a striking illustration of the immense power required to drive such huge liners. Calculating the strength of twelve men as being equal to one horse-power, and remembering that the machinery of the *Lusitania* developed 70,000 horse-power, it would require 840,000 men to produce that amount of energy. Men, however, could only work eight hours at a time, so that three times that number would be required. It would, therefore, take all the men in Scotland to supply the energy produced all the day round by the machinery of the *Lusitania*.

The International Hygiene-Exhibition opens in Dresden in May and continues until October.

Merchant Service Guild.—The statement of accounts for the year ending December 31st, 1910, shows the income to have been £6,940. After payment of expenses, a balance of £2,313 remains in hand. The reserve fund amounts to £32,000.

Messrs. Yarrow & Co. recently launched the first-class torpedo-boat *Soridderen* for the Danish Government. The vessel is 181 ft. 9 in. long by 18 ft. beam, and will have a speed of 27 knots. She is fitted with Brown-Curtis turbines of about 4,000 s.h.p.

INSTITUTE OF MARINE ENGINEERS.

Twenty-Second Annual Meeting.

THE twenty-second annual meeting of the Institute of Marine Engineers was held in the Abercorn Rooms, Liverpool Street Hotel, London, E.C., on March 10th, Mr. Alexander Boyle (vice-president) presiding, in the unavoidable absence of Sir David Gill, K.C.B.

In calling upon the hon. secretary to read the annual report, the chairman drew attention to the fact that the membership of the Institute had increased by thirty per cent. during the last five years. He referred to some of the departments of the Institute's work, and said that in his opinion those engineers who were alive to the interests of their profession and anxious to keep acquainted with the advances of engineering science, would do well to associate themselves with the work of the Institute.

The hon. secretary (Mr. James Adamson) then submitted the annual report, which showed that the membership stood at 1,229, an increase of fifty-four for the session. In all, fifteen papers and lectures had been delivered. These, together with the discussions upon same, had been issued to the members, the monthly issue of the Transactions having been found to give great satisfaction. During the session five Bohemian concerts have been held and eight visits paid to works, exhibitions, etc. The Awards Section comprised the Denny Gold Medal, the Lloyd's Register Scholarship of £50 per annum tenable for two years, the Stephen Awards to Associate Members and Associates, the Ritchie Award to Graduates and an Open Competition Award presented by Mr. Robt. Clark (companion). An important matter touched upon was the initiation of a special fund for the purpose of acquiring city premises. A circular had been issued stating that a sum of from £15,000 to £20,000 would be required, and asking for the co-operation of members and of marine engine builders, shipowners, shipbuilders and others, in obtaining this amount. It was stated that the committee were gratified at the measure of success which had already attended the issue of the circular and would publish a list of the donations received at an early date.

The hon. treasurer (Mr. A. H. Mather) then presented the revenue account and balance sheet for the session. The revenue account showed a credit of £70 11s. 11d. carried forward to the balance sheet, the total addition to capital being £199 1s. 11d. for the session, and the value of the Institute's assets £3,800. The nett amount received from subscriptions was £953 18s. 11d., and the amount paid for the printing of the Transactions issued to members was £409 3s. 2d.

The adoption of the Reports was proposed by Mr. W. McLaren (member), who congratulated the council and members upon their satisfactory nature, commenting more particularly upon the value of the papers read during the session on the internal combustion engine and other subjects of topical interest to marine engineers, and Mr. E. T. Lloyd (member), who seconded the motion, referred to the influence of the Institute in upholding the status of marine engineers generally.

The motion was carried unanimously.

A vote of thanks to the retiring president (Sir David Gill) was accorded on the proposal of Mr. J. T. Milton (chairman of council), who commented upon Sir David's work as an astronomer and its bearing in relation to navigation; seconded by Mr. Robt. Leslie, R.N.R. (vice-president).

A vote of thanks to the office bearers and members of council was proposed by Mr. J. Hallett (member), seconded by Mr. W. E. Farenden (member), responses being made by Messrs. J. G. Hawthorn, D. Hulme and John McLaren, three of the retiring members of council.

Votes of thanks were also accorded to the hon. auditors, Messrs. J. Clark and A. Robertson, and to the hon. solicitor, Mr. W. Archer, who were duly re-elected.

The scrutineers of the ballot papers, Messrs. Jas. Robertson and A. E. Sharp, then announced the following as the result of the election of office bearers and members of council to fill the five vacancies for session 1911-1912:—President, The Most Hon. the Marquis of Graham, C.V.O.; hon. secretary, Mr. Jas. Adamson; hon. treasurer, Mr. A. H. Mather; members of council, Messrs. J. Blackett, W. E. Farenden, J. Hallett, W. Veysey Lang and F. M. Timpson.

A considerable portion of the time was taken up in the consideration of recommendations and suggestions from the members as to the internal arrangements of the Institute, and the meeting closed with a vote of thanks to the chairman, on the proposal of Mr. F. M. Timpson, seconded by Mr. A. Robertson.

Lloyd's Register Scholarships and Essay Competitions.

THE attention of those interested is directed to the following named awards in connection with the Institute of Marine Engineers and the regulations pertaining thereto. Lloyd's Register Scholarships (for Graduates' and Associates' Sections), two in number, and each tenable for two years at £50 per year. Application by intending candidates should be made not later than June 1st in order that arrangements may be made for the examination, which will be held during June or July. The examination papers will be set from and based upon the following subjects:—Algebra, including quadratics; elements of statics, dynamics, thermodynamics and hydrostatics; Euclid, books i., ii., iii. and iv.; general knowledge, English grammar and composition; mechanics' principles and problems; French or German; plane trigonometry, including logarithms, practical engineering and workshop practice.

Stephen awards, two in number, for Associate members and Associate sections, value £2 each; Ritchie award for Graduate Section, value £2; Open Competition award for graduates and apprentice engineers, value £2 2s. These awards will be granted to the writer of the best paper—if deemed of sufficient merit—in each class on the subjects stated as under:—Associate members: The marine boiler, its care and supervision at sea and in port, with a view to its preservation as well as its efficiency, including a description of the appearance of a well-kept boiler when opened up at the end of a voyage. Associates: The producer gas engine, its principles and its possibilities in connection with marine work. Graduates: The steam engine indicator, its history and application. Open Competition: Improvements in workshop practice in respect to machinery and fitting.

Intending candidates should write for further particulars without delay, to the Secretary, Institute of Marine Engineers, 58, Romford Road, Stratford, London, E.

Institute of Marine Engineers.—The following visits have been arranged by the Institute:—May 27th, to the Beckton Gasworks, North Woolwich, at 3 p.m.; July 15th, to Charing Cross, West End and City Electricity Supply Co., Ltd., Marshgate Lane Station, Bow, E., at 3 p.m.

THE MARQUIS OF GRAHAM, C.V.O.

(President of the Institute of Marine Engineers.)

THE choice of a President is an important event to any Society, and when the choice of the office-bearers and council is ratified by the members, and unanimity prevails then indeed there is cause to rejoice. At the annual meeting of the Institute of Marine Engineers held on March 10th, the Marquis of Graham was declared elected as President, under the happy circumstances of unanimity with choice, and the Institute is to be congratulated on the new President, who we are assured will be as deeply interested in its work and progress as any of his predecessors in the chair and will at the same time represent the dignity and value of the Institute as worthily. The Marquis of Graham, eldest son of the Duke of Montrose, was born in 1878, and at the age of 18 commenced his sea experience as a volunteer on board the full-rigged three masted corvette, *Volage*. After 18 months' sea service thus, he was attracted by, and was in full sympathy with, Messrs. Devitt and Moore's excellent scheme of training apprentices with a view to making them good, self-reliant seamen, who would ultimately qualify for officers and commanders. The Marquis served as 5th officer in the full-rigged ship *Hesperus* in charge of the apprentices sailing to Australia; and in 1899 he passed the examination and obtained his certificate as Master Mariner, endorsed for full-rigged sailing ships and steam. He was then appointed as Navigating Officer of Lord Brassey's yacht *Sunbeam*, voyaging to Australia, thence to the Cape,

The Marquis of Graham, C.V.O.

via the Straits Settlements and Madagascar. A further extended voyage was to Canada, visiting Quebec and Montreal. Having fulfilled the conditions pertaining to the office, he was elected a younger brother of the Trinity House. In 1900 the Marquis when serving in the Naval Brigade on board H.M.S. *Doris*, was engaged in the South African war, and obtained a medal and three clasps as a memorial of his service. He was in 1903 appointed a Commander of the Royal Naval Volunteer Service, in which he has taken a very deep interest and devoted himself to it with great acceptance in this connection, especially with the Clyde Division. His association with the *Rattler* as an experimental vessel fitted by Messrs. Beardmore with gas engines is well known, not only on the Clyde, but throughout the world of shipping on account of the value attached to the results of the experimental engines. Like his immediate predecessor in the Presidential chair of the Institute—Sir David Gill, who is a master in the subject—he has studied astronomy, giving close attention to solar eclipses and devising the instrument known as the Graham Coronograph, which can be seen in use at the Royal Observatory, South Kensington. It is interesting to observe that he obtained the first biograph film taken of a solar eclipse. A Commander of the Victorian Order, it is evident that the Marquis has acquitted himself as becomes one with his qualifications and privileges, holding his high office not as a sinecure, but as an incentive to work and energy in the right direction *pro bono publico*. The various societies connected with seafarers are naturally held in touch by one so fully interested in the progress of ships and those who man them, and the Royal National Lifeboat Institution, the Merchant Service Guild, and the National Committee for the Training of Seamen from boyhood, have had their claims allowed upon his time and attention.

Having given some thought to things political, he stood for Parliament three times, and in 1905 became private assistant secretary to the Chancellor of the Exchequer, but the following year he turned his steps to trade and commerce and joined the firm of Messrs. Beardmore, of Dalmuir and Parkhead, Glasgow, as a Director. A Director also of the Caledonia Motive Power Supply Co., he was instrumental in arranging for the excellent presentation at the large stand in the Olympia Exhibition last year, of exhibits by both firms, which well deserved the special commendation they received. The firm also exhibited at the Yarmouth Motor Exhibition last October and were awarded a first prize and a gold medal for their marine oil engines. As previously noted in our pages, the Marquis is now building for himself a cruiser yacht and set of crude-oil engines to compete in the great Venice to Rome race of 1,200 miles next July in connection with the Turin and Rome Exhibitions.

Messrs. Callender's Cable & Construction Co., Ltd., of Hamilton House, Victoria Embankment, London, E.C., have recently issued a fine photogravure of the H.M.S. *Thunderer*. The main electrical distribution on this vessel has been entirely effected by means of Callender's cable and special boxes.

The "Titanic."—It has been announced in Belfast that the launch of the White Star liner *Titanic* will take place on May 31st.

THE FLEETS OF THE MAIL LINES.

(*From our Own Correspondent.*)

The Cunard Company

makes rather a sensational announcement in its official declaration that it has bought the passenger side of the business of the Cairn Line, Ltd. The fleet taken over is not—as far as size is concerned—one of the highest importance, the total tonnage of the three steamships acquired not being equal in amount to that of one of the vessels *Lusitania* or *Mauretania*. But the significance lies in the fact that the premier Company of the Atlantic thus attains a footing—and that as a conference line—in the St. Lawrence trade, and at the same time makes the Thames one of its termini and Southampton a port of call. Moreover, though at first the passenger service to Canada under its auspices will only be maintained at fortnightly intervals, it will be capable of prompt and great extension the moment that the experiment is justified and the trade warrants a change.

The three ships purchased are :—

Ship.	Year built.	Builders.	Tonnage. Net.	Gross.
1. *Cairnrona* ..	1900	Swan & Hunter ..	3,960 ..	6,025
2. *Tortona* ..	1909	Do. ..	4,952 ..	7,907
3. *Gerona*	1911	Do. ..	— ..	—

The first-named of these three ships was constructed for the Wilson Line and was originally named *Consuelo*. She was purchased by the Cairn Line in 1908. The last-named was only put in the water on the 6th March of the present year. She was being fitted prior to her purchase as a passenger steamship of the highest class, having accommodation for some 140 saloon passengers, besides considerable numbers of others, and having submarine bell receivers and a wireless installation. She is to be of greater tonnage and improved design to her sister the *Tortona*. As I have said, the Cairn Line retains its cargo service and will run its vessels in the London-Canadian trade alternate weeks with the ships transferred to the Cunard Company, whilst at the same time it will devote much attention to the development of the trade between Italian ports and North America.

The steamships include the fleet of the old Thomson Line of Dundee :—

	Year built.		Tonnage. Nett.	Gross.
1. *Bellona*	1881	Gourlay Bros., Dundee	1,864	2,932
2. *Fremona* ..	1887	Do., do.	1,876	2,222
3. *Jacona*	1889	Jas. Laing, Sunderland	1,951	2,969
4. *Iona*	1892	Gourlay Bros., Dundee	2,085	3,344
5. *Hurona*	1892	Naval Constr. Co., Barrow	2,150	3,432
6. *Cervona*	1896	C. Connell & Co., Glasgow	2,372	3,779
7. *Devona*	1896	Do., do.	2,372	3,779

The *Cairnrona* was purchased after the acquisition of the Thomson Line, and, of course, the *Tortona* also was delivered after that event. The Cairn Line of Steamships, Ltd., comprises some nine steamships, and in addition there are under the same management—that of Messrs. Cairns, Noble & Co.—two vessels owned by the Cairnglen Steamship Co. and four by the Gaelic Steamships, Ltd.

The Cunard Company has purchased the Belgium-owned steamship *Clematis*, which was built in 1900 at Newcastle by the Tyne Shipbuilding Company. The vessel has been renamed *Caria* and will be employed in the Mediterranean service. There is one thing in connection with this progressive steamship line which I have never been able to understand. It is why the connection with Havre should for so many years—ever since the old *British Queen* was sold to ship-breakers in 1899—have been maintained by chartered tonnage. The steamship *Liverpool*, of Barrow, was first employed, and now that she is under overhaul, another small vessel has been taken up. Surely it would be cheaper to own tonnage for this work, or, if not, why not apply the chartering system to other branches of the service ?

The Turkish Shipowner

seems to be buying a good deal of tonnage. He is reported to have absorbed two of the Fleetwood mail and passenger steamships, the twin-screw *Duke of Lancaster* and *Duke of York*. The former vessel was built at Barrow by the Naval

Construction & Armaments Co. in 1895, and the latter a year earlier at Dumbarton by Messrs. Denny. Turks are also the purchasers of the two liners *Port Antonio* and *Port Royal*, which are being disposed of by the Imperial Direct Line, now that the Government has withdrawn its subsidy. The two vessels in question were built in 1901 at Middlesbrough by Sir Raylton Dixon & Co. They are, of course, of a special character, having been designed entirely for the needs of the trade which they were constructed to develop, and have a speed which could not have been provided in the absence of a Government grant. We get here an example of how shipowners are treated by the British Government. A subsidy necessitating by its conditions the construction of a whole fleet of steamers—which are unlikely to be able to earn a living in any other trade—is granted, the contractors being naturally induced to think that if they fulfil their obligations punctually they will obtain a renewal of their contract—even if, with the sharp practice for which Departments are notorious, they find the payment somewhat reduced. Instead of renewing, however, the Government calls for an entirely different service for which its own contractors' vessels are unfitted, and a new firm are building a new fleet. Two vessels have already been launched for the new service—which is undertaken by Messrs. Elders and Fyffe—the second being the *Manzanares*, built by Messrs. A. Stephen & Co., of Linthouse. Their tonnage is about 4,400 gross register, which is practically the tonnage of the vessels now being dispersed to foreigners.

London Steamers.

Amongst recent sales I notice that another of the unfortunate little paddle steamers built for the London County Council's abortive service has been sold foreign by the City Steam Boat Company, who, I am glad to say, seem to have realized a much more satisfactory price for her than her original owners were able to obtain. That the private company is now reducing the number of its vessels, and that at a time when summer and the Coronation crowds are so near, would seem a rather unhopeful sign of the prospects of the enterprise.

Billiards at Sea.

As bigger and bigger vessels have been constructed for the various passenger lines of the world, there has from time to time been a certain amount of chaff as to the provision of billiard tables and the possibility of their use. But, according to the *Journal of Commerce*, the matter has got beyond the stage of chaff. An entirely practical Company—the Canadian Pacific Railway—has actually initiated a serious experiment in this direction, having fitted up a billiard-room on their steamship the *Empress of Ireland*, prior to her voyage to Canada commenced at the end of February. Weights, air-cushions and other arrangements are provided to keep the table level at all times, and it was said that, prior to the sailing of the steamer—when she was loading and moving out of dock—even the spirit level failed to show any movement or departure from the true position.

South African Mails.

The Union Government seems disposed to pander to the views of those who engineered the appointment of the Royal Commission on Shipping Rings, which held so many sittings and took so much mis-called evidence a few years ago. At all events it proposes to legislate against Conferences, and to refuse to have dealings with Companies which give rebates. To the suggestion that it will find it difficult to meet with a steamship Company which will take the line on which it insists, it answers that it is considering the idea of starting a line of its own. Of course it is a State Government and the London County Council is only a municipal body—though it may be that the population and wealth, if not the actual area, of the County of London are comparable with those of the Union. The London County Council—relatively to the amount of capital it embarked—paid very dearly for the lesson that shipowning is a business of its own, requiring special knowledge and special management. Will the Union Government really be so foolish as to spend millions to learn this obvious lesson?

But there is one thing which is open to the shipowner—if only he would take a leaf out of the book of the Canadian Pacific Railway. He might develop for himself a passenger and goods traffic which would earn him good dividends—in spite of Government interference and without Government aid—if he would only turn his attention to the development of agriculture in the Union and to the settlement of British-born farmers on the lands now waiting for development.

The Reports of the principal German Companies

are now published and the Hamburg-American Company shows a strong position enough. The nett profit is over 10 millions of marks, against about 7½ millions the previous year. Over 4 millions more is allowed for depreciation. Increased sums are allowed for insurance and renewals, and a considerable increase is shown in liquid assets, that is to say, there are large funds available for the building of new tonnage, or for the purchase of existing fleets. In the report the fact is mentioned that the process of turning the old mail steamer *Deutschland* into a public yacht is still in progress. She will, it is said, be the finest vessel of her kind—as well, of course, as the largest—when she is completed. But she is the *Deutschland* no longer. Her new name is *Victoria Luise*.

The Nord-Deutscher Lloyd on the other hand confines its distribution to the moderate figure of 3 per cent. But this is against no dividend last year.

"The Waratah."

Judgment has at last been delivered in this case, but it helps one very little towards any conclusion towards the matter. The Court is convinced that the vessel foundered when just past East London, and that she went down so quickly that there was no time for deck-movables to get away from her. This, with respect, seems highly improbable. A ship is not like a rowing-boat, which, when it turned right over would hardly allow anything to get from under its gunwales. There would be a breaking of masts, a crushing of funnel, in the first place, then probably a smashing of the upper deck erections, even if she managed to lie quite keel uppermost. The absence of any vestige of wreckage is much more likely to be due to the influence of the Aghulas current, which would carry the movables into the Indian Ocean. Anyhow, the Court covers those connected with her. It seems to suggest that she capsized owing to a coincidence of several unhappy factors. She was a stable ship, but tender. She was properly loaded, but there was a little too much weight high in the ship. She was caught broadside on by a heavy gale and a monstrous beam sea. I am somewhat at a loss to understand why so little point was made by the Court of the fact that a Union Castle liner, the *Guelph*, reported a steamer—the last letters of whose name were *tah*—as off Hood Point at 9.51 p.m. on the 27th July. If this evidence were accepted it would indicate that the vessel must have broken down after passing the *Clan Macintyre*, but taking into consideration the fact that that vessel did not sight her a second time the Court concludes that the officers of the *Guelph* must have been mistaken. But it is possible that they were right, and if they were, a complete break-down of the machinery and a falling of the ship into the trough of the sea, might account for the disaster. Strangely enough, the enquiry was barely ended when the report came that a 4,000-ton steamer, the *Palatinia*, of Manchester, had struck an unknown object 30 miles west of East London and received so much damage that she had to be beached, and was, indeed, likely to prove a total loss. It was suggested that the obstruction might be the remains of the *Waratah*. The master of the injured vessel seems to incline to the belief that what he struck was a rock, and, indeed, there have been similar occurrences reported in the same neighbourhood even before the disappearance of the *Waratah*.

The P. and O. Company

has the honour of providing a steamship—one of its two new "M's," the *Medina*—for the Royal voyage to India, when His Majesty is to be crowned at Delhi as Kaiser-i-Hind. Though, I fancy, a trifle less in tonnage than the *Armadale Castle*, in which it had been arranged for King George, as Prince of Wales, to travel to South Africa for the inauguration of the Union, the *Medina* will be quite as fine a ship. She is about twice the size of the Orient Liner *Ophir*, in which, as Duke of York, our present Monarch went round the Empire, and is infinitely larger and more comfortable than the battleship *Renown*, in which the last visit to India was made. The sister-ship *Majola* is appointed to make an extra voyage with guests from England to the Durbar.

MODERN DEVELOPMENTS IN BRITISH AND CONTINENTAL OIL ENGINE PRACTICE.*

By Mr. E. Shackleton, A.M.I.M.E., A.M.I.Mar.E.

In presenting a paper on the above subject, the author feels that the marine engineer cannot much longer afford to neglect the advantages to be derived from the use of the internal combustion engine, in one form or other, for powers where 1,000 to 2,000 h.p. will not be greatly exceeded, but the general trend of opinion seems to be that whilst the subject is a very fine one for papers and discussions, the adoption of the new form of prime mover had best be left to their successors. However, the interests of all parties have been aroused and, that being the case, the problem is likely to receive in the future continually increasing attention.

It may be of interest, before proceeding with the paper, to call attention to the very excellent pioneer work done by Messrs. Priestman who, with "Eteves" patents made the first successful oil engine for stationary work and who, moreover, were the first, or almost the first, to adapt the oil engine for marine propulsion. Many features of the Priestman engine were doubtless in advance of the times, such as the spray maker introducing the oil into the vaporizer, the electric ignition and compressed air for starting. It is to be regretted that they have now ceased to manufacture oil engines. In a paper of this description it is not proposed to deal with engines using petroleum spirit, as these do not come within the marine engineer's proper sphere and are not of general interest, and it is obvious that the conditions of economy and safety for engines in use on every day shipboard, put them out of discussion. The merits of the heavy oil engine are very great and in this paper it is proposed to call attention to various makers of engines using "Crude," "Residuum" or "Intermediate" oils. The term "Crude" or "Residuum" oil is apt to be misleading, as various shale oils (such as Scotch products) of widely different quality are occasionally referred to under this indefinite name. The products of the Texan, Borneo, Russian, Galician, Mexican oil fields are of a different character, due to the fact that they are natural products, whereas the Scotch oils are only produced by distillation.

The majority of oil engines will give excellent results on Scotch crude and semi-refined oils if designed for crude fuel, but to assume that the same holds good on the residuum would be a bold assertion. There are among the group of residuums, oils that may be used as fuel for an oil engine, but could not be recommended for continuous runs, as their constituents of tars, bitumen, sulphur, etc., are very much opposed to satisfactory and economical working. There are, however, still a reasonably large number of residuums which adapt themselves to oil engine running. The marine oil engine has many recommendations to commend it to the marine engineer. It is infinitely less complex than the steam engine with accessories, boilers, condensers, pumps, etc., occupies less than half the space of the same and effects great saving also of fuel space. It goes without saying that it will need no funnel in the ordinary sense of the word. At the same time, however, it is as well to remember that the exhaust products will have to be discharged at some point, and therefore some provision will have to be made and both smoke and smell are encountered in the best types of oil engines. It occurred to the author that marine engineers generally may have a desire to have some definite information as to the various components of so-called crude oil, chemical composition, etc., and he has therefore given particulars herewith from that excellent work "Petroleum and its Products," by Sir Boverton Redwood.

"When heated, crude petroleum gives off condensible vapours. Here are examples of the volatilization of the various strata forming the crude.

"1st Stage.—Benzine, Gasoline, etc., which are yielded at up to 300° F.

"2nd Stage.—Paraffin, Kerosene, at temperatures up to 500° F.

"3rd Stage.—The products of mineral lubricating oils.

"Real crude oil varies in specific gravity from 800 to 950 (American and Russian crudes)."

All crude oils have a proportion of asphalt in them and in many cases the Baku oils yield a residuum of 40 to 60 per cent. There is also a large variety in the yield of paraffin or kerosene from various crudes, some containing as high as 70 per cent., others being as low as 8 to 9 per cent. An oil containing 60 to 70 per cent. of paraffin would doubtless gladden the heart of any heavy oil engine builder who desired to operate his oil engine with it. The flash point varies between 25 to 70° Cent. (=77 to 158° F.) with different oils. The following gives some idea of the component parts of crude petroleum:—

"Bitumen, tar, coke, sulphur, paraffin, vaseline, sulphuretted hydrogen, carbon, bi-sulphide of carbon, arsenic, phosphorus, calciums, oxides. In some samples of Baku oil as high as 24 per cent. tar has been found."

It may be assumed that if the adoption of the oil engine for marine propulsion becomes general and boats replenish their oil tanks at various depots through the world, there will be a great dissimilarity of performance by the engines from time to time, as an engine doing well on Borneo, Mexican or American oil or similar crudes would only do passing well on, say, certain Baku or Galician fuels. It is to be hoped, however, that a universal standard may be arrived at in this matter.

I give below a suggestion.

Fuel Oil Standard.

1. Fuel oil.	Colour, black.	Spec. grav.	930-940.
2.	brownish black.	..	900-920. Admiralty standard. Flash not to exceed 200° F.
3. .. .	brownish black	..	875-880.
4. Gas oil. ..	Red.	..	850-860.
5. No. 1 Paraffin. ..	pale straw.	..	815-835.
6. White	white	..	800-810.

The B.T.U. of residuum of crude oils varies between 18-21,000.
Number 4 is semi-refined oil.
Numbers 5 and 6 are refined oils.

Few of the obtainable fuel oils are bona-fide crudes and it will be at this point distinctly understood that the majority of such have been treated in the stills, *i.e.*, had the volatile and other products distilled from them. Genuine crude oil has, the author believes, been used in a few cases, but apart from using the raw product, which frequently contains sulphur and which is very detrimental to an oil engine, it is quite obvious that in commercial practice it would be exceedingly risky to use, as in this state its naphtha and benzine components, once in contact with air, become dangerous as an explosive, and it is to be assumed that no owner of a ship would even consider carrying such fuel.

The following table may be of interest as showing the great increase in the production of petroleum from various countries.

The World's Production of Petroleum. From the "Petroleum Review," March, 12, 1910.

Producing Country.	1909. Tons.	1908. Tons.	1907. Tons.
America	25,000,000	25,700,000	22,400,000
Russia	7,900,000	7,500,000	7,680,000
Dutch Indies	3,000,000	2,500,000	2,000,000
Galicia.....	2,150,000	1,750,000	1,170,000
Roumania	1,300,000	1,150,000	880,000
India	780,000	600,000	550,000
Other countries .	550,000	450,000	450,000
Total	40,680,000	37,650,000	35,130,000

The advantages of an oil engine for marine work over the steam engine are many and the author does not propose to traverse over ground in this direction beyond the following points:—

(1) Space occupied only 60 per cent. in comparison with steam. (2) "Stand by" losses nil. Steam 15-20 per cent. of fuel consumption. (3) Water required for cooling, half of that required for condensing purposes. (4) Minimum of labour and time in replenishing fuel. (5) Practical elimination of firemen and trimmers. (6) Considerably reduced fuel space, giving (7) Increased cargo space. (8) Weight of machinery much less than steam.

* Read before the Institute of Marine Engineers on Monday, the 20th of March, 1911.

Having enumerated the advantages of oil engines it will be as well also to review some of the disadvantages.

(1) Are dependent upon compressed air to effect reversing (Bolinder's excepted) and starting. (2) Will require an extra good bed or sole plate on shipboard, the vibration being in excess of steam. (3) Are fairly high revolution engines. (4) Failure of compressed air supply would entail inability to start or reverse. (5) Disadvantage of a clutch in engines directly reversible. (6) Engines are generally not so easy to handle at low speeds as steam.

Objection 1 is not now a serious factor. No. 2 is a matter for the shipbuilders. No. 3, propeller speeds not so high as the turbine. No. 4, this is referred to later in the paper. No. 5 is also dealt with in another portion of the paper. No. 6, this disadvantage is now rapidly disappearing as the new multi-cylinder engines are exceedingly flexible and can be reduced to less than one-third of their maximum speed when required.

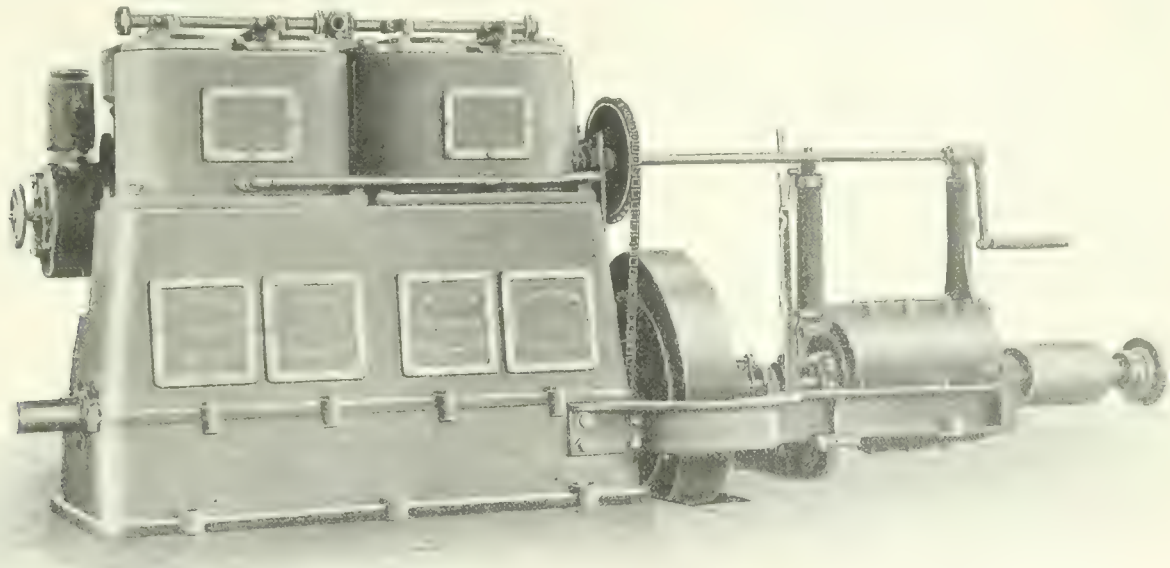
Notwithstanding the advantages to be derived from electro-transmission it would appear that in moderate power installations, no shipbuilder or shipowner is seriously inclined to consider such system on whole power lines (owing to the heavy cost of installation), but where this class of transmission is desired for reversing purposes, slow speeds, etc., it would appear that the Mirrlees proposed system has much in its favour, but, even under such circumstances, the reversing engine is bound to become paramount in the long run. Before proceeding further it is advisable to classify the various types of engines, and accordingly the author has tabulated the following :—

Engine.	Cycle.	Size.	Fuel.
*Diesel, Sulzer and M.A.N. ..	Otto and Two-cycle	100 to 2000	Heavy residuum
*Blackstone ..	Otto	70 .. 20	,,
Bolinders	Two-cycle	50 .. 400	Semi-refined oil
*Griffin	Otto	50 .. 150	Heavy residuum
*Diesel, M.B. and D.	Otto	50 .. 300	. .

*These engines also work with Scotch shale oil, gas oils, solar oils, semi-refined and refined paraffin and, in some cases, with gas tar oils.

For commercial purposes generally and for the review of these motors before the Institute it is not considered desirable to refer to any engine whose power is less than 50 b.h.p. The Beardmore engine has also been omitted, it being the subject of a special paper to the Institute some year or two back. It is also totally impossible to deal, in a paper of this description, with more than a limited number of engines and such as shall prove of the most interest and whose principles are likely to appeal to marine engineers and to provoke discussion.

DIESEL ENGINE.—The Diesel engine is a unique motor and, as a marine prime mover, will certainly take some ousting from its premier position. As far as can be ascertained it is the practical pioneer of engines using residuum fuels, although it must be distinctly understood that even this engine will not operate on any or all residuums. The cycle of operations in the cylinder of a Diesel engine may be described as follows : (1) Outstroke of the piston on which pure air is drawn into the cylinder only. (2) Return stroke of piston compressing air. (3) End of compression and injection of fuel oil finely sprayed into the cylinder, which is immediately followed by slow burning or expansion work being done on the piston. (4) Return of the piston at end of expansion stroke and discharge of exhaust gases.

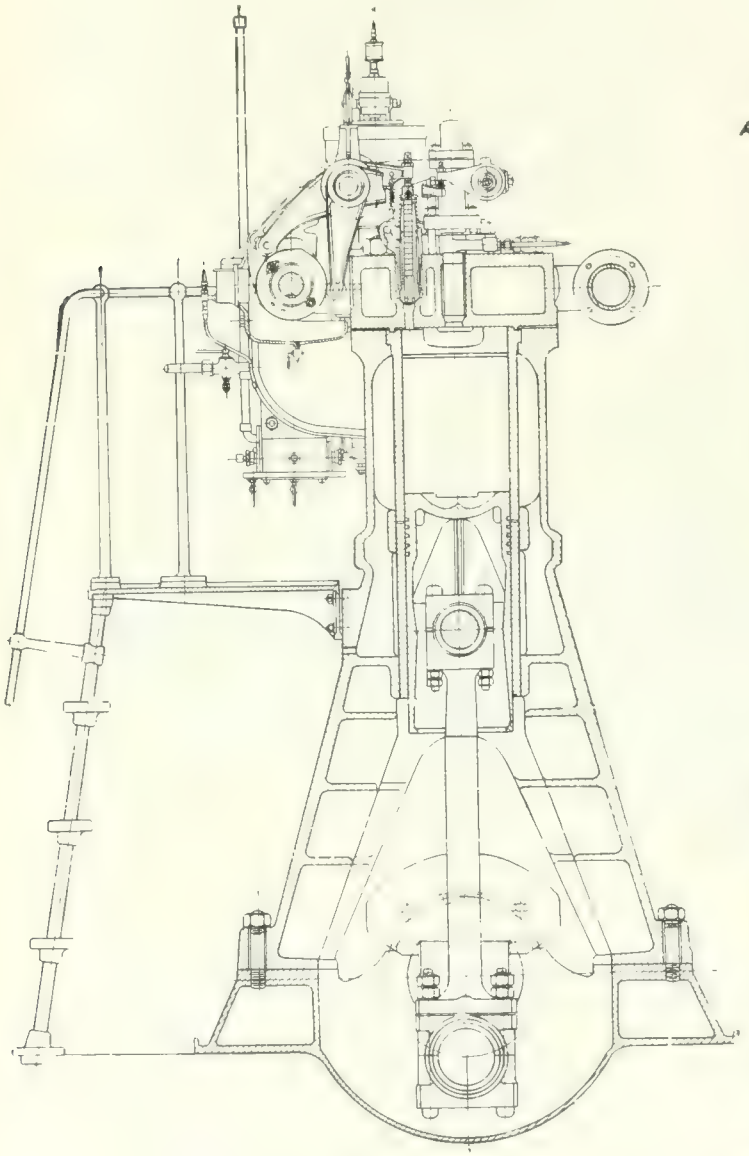


Griffin Enclosed Marine Type Engine, 80 to 300 H.P.

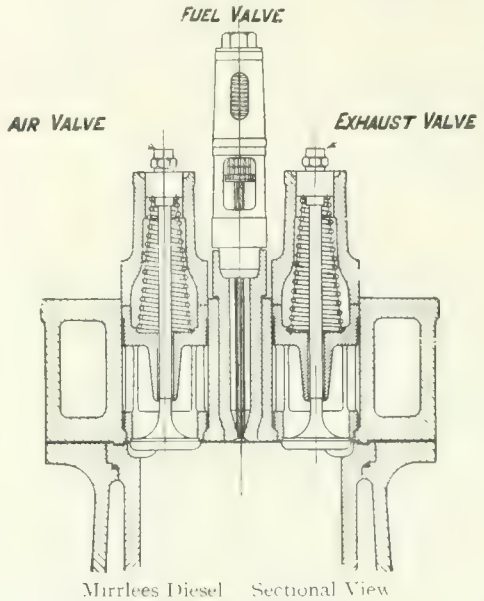
The temperature of the compression may vary between 1100°F. and 1,200°F. Its principle of high compression and injection of fuel prior to immediate spontaneous burning is very satisfactory and under all normal conditions it is a very reliable engine and eminently adapted for marine work. The Diesel engine is built in England by Messrs. Mirrlees, Bickerton & Day, Stockport, Willans & Robinson, Rugby, and it is probably of interest to note that Messrs. Mirrlees, Watson and Co. built the first Diesel in this country at their Glasgow works in 1897. Abroad the Diesel engine is built by Maschinenfabrik Augsburg-Nuremberg A.G. at their various works in Germany. In Switzerland the builders are Messrs. Sulzer Brothers of Winterthur, and also the Swiss Locomotive Works for certain sizes, under licence to Messrs. Sulzer Brothers. In Italy by Franco Tosi Legnano. In Denmark by Burmeister and Wain, Shipbuilding Works. In France by Augustin Normand. In Belgium by Carels Freres, Ghent. In Holland it is also now being constructed by Nederlandsche Fabriek van Werktuigen en Spoorweg-Materieel. This firm, by the way, have been the builders of the engine for the O.S. *Vulcanus*. The American builders are the American Diesel Engine Co. It will be thus seen that the vast potentialities of this motor have been appreciated by many of the world's greatest engine builders, who now

build it. In thermal efficiency it is high and gives 1 b.h.p. on a consumption of not exceeding ½ lb. of fuel per hour, full load, and runs for long periods with little or no attention, and many examples have been afforded where these engines have run one to two months without stop. While possessing so many salient features it may here be as well to emphasize the fact that the Diesel engines are expansive motors, *i.e.*, the maximum pressure is more gradually attained and doubtless much shock is eliminated thereby, as with other forms of internal combustion engines the maximum pressure is reached immediately after ignition, and moreover the explosion in the ordinary type of gas or oil engine is altogether of a more violent type, and it is one essential detail which pertains to the Diesel system only enabling relatively slow expansion, to be possible, conditions which are not obtainable in any other internal combustion engines. For instance, to carry the compression of an oil engine much beyond 70 to 80 lb. per sq. inch or of a gas engine beyond 200 lb. per sq. inch would, in the ordinary course of events entail pre-ignition of the charge at about ⅔ to ⅞ of the compression stroke. High compressions on an oil engine give marked detonating explosions and would not be considered for one moment by a builder as sound practice and, in gas engines, although the practice of extra high compression has of late years been largely adopted, it is recognised that the life of the liner and piston of such engines considerably shortened.

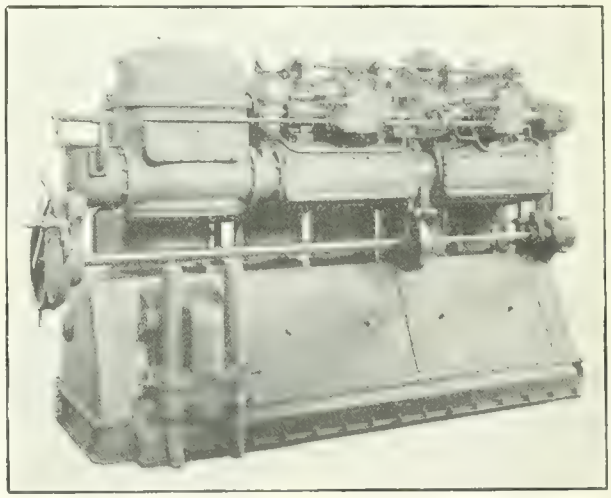
Apart from explosion pressures it is apparent that the extremely high explosion temperature consequent on high compression, while effecting greater efficiencies for the time being, has very serious disadvantages, and moreover the general practice of high compressions, which began to be prevalent some years ago and finally ended in a general scramble among the gas engine makers as to who would go the highest, is anything but ideal; the author indeed considers it the reverse of ideal. To be brief, competition for business among makers is now so keen that what was, say for comparison, an 11 b.h.p. engine ten years ago of moderate compression is now given a high compression and frequently rated at 14 to 15 b.h.p., the bore and stroke of the old and new engines being almost identical. Thus it has become recognised by oil engine builders that, if results are to be obtained on a par with the Diesel, wide divergence is necessary from established practice. In one detail alone the Diesel system scores heavily, *viz.*, that of total absence of ignition apparatus, for, whether ignition be by so-called automatic system or by hot bulb, magneto, or other methods, extra attention is re-



Mirrlees Diesel Engine. Section Through



Mirrlees Diesel Sectional View



600 800 H. P. Reversing Sulzer Marine Diesel Engine—Latest Type

quired if they are to be kept in first-class order. Moreover, with the Diesel system of injecting or spraying the fuel oil, most excellent combustion is obtained with the minimum of deposit. In the majority of oil engines on other systems considerably heavier deposits take place during the vaporization or combustion of the charge, entailing much more frequent openings up and removal of the same. Diesel engines, however, do not run at their best at very low speeds, being somewhat inclined to foul, neither is it advisable to run them with low water jacket temperatures, but neither of these conditions need be a serious factor. That this engine is expensive to build must be of necessity, as none but the finest workmanship and materials can be used, and, moreover, it must be extremely solid in its structure. It will be understood that the manufacture of the Sulzer-Diesel marine engines calls for the supervision of a special staff, and it is obvious that the conditions are entirely dissimilar from those pertaining to stationary engines, as each engine of the marine type has to be specially designed and built for each individual ship, hence the initial stages in the construction of them are costly and slow. Messrs. Sulzer, whose name is famous as makers of the Sulzer steam engine are quite satisfied that the Sulzer steam engine with all its refinements, superheating, condensing and Corliss type valves, able to give 1 i.h.p. on a consumption of steam between 10½ and 11½ lb. per hour, have no chance as to economy or efficiency when paralleled with the Sulzer-Diesel engine. Herewith are some tables showing comparative cost of steam and oil engines.

Table "A."

Steam Engine.

Fuel—Coal.	Labour.	Fuel.	Stand by Losses.*
1,500 i.h.p. × 1½ lb. per i.h.p. = 2,250 lb.	10 Firemen, Trimmers and 1 Donkeyman 1s. per day per man = 11s per day. 7 days per week = £3 17s. Wages £1 week each £11	24 tons 2 cwt per day at 14s. = £16 17s 4d. £118 1s 4d. per week.	Assuming 20 days per annum, 5 tons per day = 100 tons = £70 per annum, say £1 7s. per week
	£3 17 0 11 0 0 118 1 4		
	£132 18 4 sum total		

* Stand by losses not in sum total

Table "B."

Oil Engine.

Fuel—Oil	Labour.	Fuel.	Stand by Losses.
1,500 b.h.p. = 1,725 i.h.p. 1,500 × ½ lb. 750 lb. per hour	1 Donkeyman at £1 per week Food 1s. per day = 7s. per week £1 7s	7 tons 16 cwt. per day at £2 per ton = say £15 15s per day or £110 5s	Nil.
	£110 5 0 1 7 0		
	£111 12 0		

Table "C."

Cargo Space Saving Compared. Oil *v.* Steam.

	Steam.	Oil.
4,000 ton vessel.	Nil.	40 per cent. on 4,000 tons = 1,600 tons, value say at £1 per ton per annum = £1,600.

Table "D."

Repairs to boilers as apart from engine repairs, scaling, new zincs, firebricks, per annum, £100.

Table "E."

Thermal Efficiencies Compared.

Steam, ordinary, as low as 6 per cent.; highest, including superheating, etc., etc., 15 per cent.

Hot air engine, from 7-10 per cent.

Oil engine, ordinary, 16-20 per cent.

Gas engine, 20-25 per cent.

Diesel System engines, 30-38 per cent.

The consumption of oil has in this, as in the case of other engines, been purposely estimated on the excessive side. But even on these figures it will be obvious that no ordinary tramp steamer with quadruple or triple engines has the slightest hope of putting up a fight on the score of running costs, and whilst by the adoption of steam turbines space might be reduced no great reduction in running costs is to be obtained. It may, at this stage, be asked why the gas engine has not developed to the extent that the author and others anticipated it would. That the oil engine is more advanced for marine work is beyond question, but to state that the oil engine had developed into being the cheapest form of power would not be entirely in accordance with facts. No oil engine has the remotest chance of competing with a gas engine on bituminous producer gas. A good oil engine, however, can surpass a gas engine operating on anthracite or smaller powers. At this stage the following table may be of interest:—

1000 h.p. Bituminous Gas Plant, 24 hours per day, supplying gas for 1000 h.p. gas engine. Fuel consumption 10 tons 16 cwt. per day at 10s. per ton = £5 8s.

Oil Engines. 1000 h.p. ½ lb. per b.h.p. per hour = 500 lbs. = 4 cwt. = 5 tons per day at £2 per ton = £10 per day.

Were anthracite or coke to be available in all parts of the world at reasonable prices some stubborn resistance would be offered by the cheaper gas power. It is astonishing that in England neither Messrs. Crossley Bros. nor the National Gas Engine Co. nor other large gas engine builders have made any definite attempt or are in a position to offer marine engines, oil or gas, of such power as is required for an ordinary going tramp vessel. The grand British total is largely summed up by Beardmore's experimental "*Rattler*," the Holzapfel producer gas boat and a number of smaller installations.

The advent of the marine oil engine has been largely assisted on the Continent by an absence of coal such as Britain possesses, hence in England for stationary work with our abundance of cheap fuel and for powers of not less than 500 horse, the oil engine can only compete under certain local conditions or for certain work or against an anthracite plant. For marine work, however, it is certain that the shipowner for some time to come will give his support to the oil engine, although the power costs are higher than would be the case of a gas engine and bituminous plant installed in a boat. But the increased cargo space which the oil engine permits would altogether predominate, as will be seen from the table "C," and would not appeal so strongly as in the case of land installations, and, in this case, would outweigh all other considerations. The question of the gas engine for marine may, however, be shelved for the time being, but it is bound to again come to the front after the oil engine has paved the way. In considering an installation of marine oil engines, whilst the variety of plants is some disadvantage, there is reason to believe that a 3,000 h.p. installation might be a compromise, as say:—1,000 horse of steam for operating centre turbine, and 2 × 1,000 horse of oil engines port and starboard.

Excellent results have been obtained in land practice with oil and steam engines installed in power stations; moreover, there are waste heat exhaust products from the oil engines that might well be utilized for steam raising or superheating. There is every reason to believe that with a Wilson exhaust boiler the oil engine exhausts would provide steam equal to 15 per cent. of their output. Hence, 15 per cent. of 2,000 horse = 300 h.p.

With a steam-oil combination, however, there would be a loss of 25 per cent. cargo space compared with an oil installation alone, but the boiler space required would not be excessive and an extra advantage would be the use of the centre turbine for docking, very slow and reversing work. Auxiliary steam would not be available, of course, when the oil engines on the port and starboard positions were not running, but this would be supplied by an oil-fired main boiler. Under sea conditions the two oil engine sets would be running and also the turbine, a large proportion of steam being maintained by the oil-fired

boiler assisted by the auxiliary boilers using exhaust gases from the oil engines.

Except under bad weather conditions the oil-fired boiler could be occasionally blown down even on a voyage, thus the steam unit could be maintained at highest efficiency, and even with the main steam boiler shut down it is probable that the turbine would be kept slowly going by the exhaust boiler steam only. Such a combination, however, is by no means essential to the installation of oil engines in a vessel, but it is obvious that the economical engineer would not view altogether with equanimity the deliberate waste of exhaust gas capable of giving him even 100 horse per hour. Moreover, provision must be made if these gases are not utilized for steam raising purposes to water-cool the exhaust pipes themselves, as uncooled pipes in an engine room from even 1,000 horse oil engine would be quite sufficient to make matters extremely uncomfortable for the engineers on watch.

Whilst every credit must be accorded to Diesel for the evolution of the Diesel engine and its principle, it must be borne in mind that although the inventor originally designed his motor for the combustion of coal dust,later search proved it to be impracticable, and so far the Diesel system can only be utilized for liquid fuel, coal gas or producer gas being,with all other forms of gas inapplicable. Slow combustion is attained in the Diesel engine, apparently owing to the fact that with its system in addition to other things greater dilution of the combustible mixture with air is possible, consequently explosion is replaced by expansion or slow burning. As far as can be ascertained no form of igniter will ignite a charge of coal gas diluted by air to more than 1-14 to 1-15 parts, these latter figures being, of course, only experimental results. Producer gas, by means of its composition and low calorific value is certainly very sluggish in ignition and certainly could not have air dilution much beyond 1-4 to 1-5 parts (*vide* Dugald Clerk and William Robinson). Were it possible in gas engine practice to obtain ignition of considerably weaker mixtures, doubtless much lighter explosions would be obtainable. But even then the slow combustion, which is a characteristic feature in the Diesel engine would not be attained. At the same time it must not be forgotten that the latest type gas engine using producer gas and of the throttle governor type gives a much less violent explosion than the older types of gas engines, the explosions being graduated by the governor, which increases or decreases the volume of the mixture.

For many years oil engine builders endeavoured when using residuum fuel to vaporize it after the manner of ordinary petroleum engines ; in fact this is still done in several engines. Their endeavours were successful as far as making vapour alone was concerned, but unfortunately, owing to variety in the temperature of the vaporizer, there were constant fluctuations between vaporization and cracking, and in the cracking process with the heavier distillates large quantities of deposit were left in the vaporizer cylinder ports, sufficient in the course of several days' running to interfere with satisfactory operation. It has now become recognised that for clean combustion, reduction of deposits, etc., vaporization of heavy fuel is better left alone, *i.e.*, no attempt made to convert the fuel into vapour, but it is sprayed direct into the combustion chamber, the heavier globules of the fuel being broken up and subjected to combustion before they can fall out and leave deposits. Thus in a measure the spray, so prominent a feature of the departed Priestman, again makes its appearance, although the modern application is, of course, different. Regarding vaporization it may be advisable to quote Professor Robinson's *Gas and Petroleum Engines regarding Cracking of Fuel Oil* :—

"When heated above their normal boiling points, the heavier hydro-carbons of the paraffin series are cracked or chemically split up, partly into lighter hydrocarbons of lower boiling points,whilst marsh gas and hydrogen are set free and a slight carbon deposit formed with tarry deposits, etc. . . heavy hydrocarbons are thus split up at temperatures above 400° F. In the oil engine a carbonaceous deposit may be produced by cracking the less volatile residue by the rapid fluctuation of temperature. Compression of the oil vapour checks evaporization and causes partial condensation, then the high temperature of inflammation instead of giving complete combustion, may result in the cracking of some oils and in the formation of residue which accumulates and in time forms the hard carbon deposits found in the combustion chambers of some engines . . On still further raising the temperature to bright cherry red drops of oil are gasified or may only be partly converted into real oil gas and tarry products, which are usually washed or scrubbed out in the process of oil-gas making (Mansfield Keith's, etc., systems), but cause trouble and stop the oil engine. It is necessary therefore to regulate the temperature of the vaporizer below this gas-making stage to prevent the formation of tar and deposit of carbon."

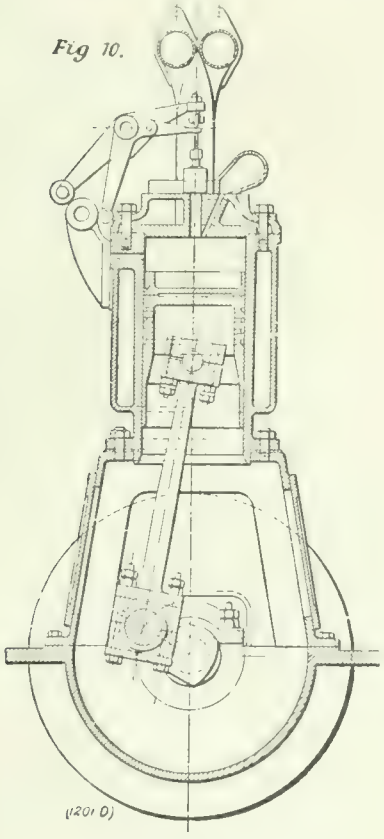
To Messrs. Priestman is due the first general employment of the water spray, *i.e.*, addition of water vapour to the explosive mixture,and which has again in recent years become prominent in certain quarters, almost being acclaimed as a great discovery. Hence, what oil engine builders are in many cases using on their latest oil engines Priestman adopted twenty years ago. Even Messrs. Priestman would not, however, claim originality for it, water being first injected to a gas engine cylinder by Brown in 1823, although for a different purpose. On the merits or demerits of water spray it is not proposed to dwell, but where water spray is to be used it is certainly an advantage if the spray will be suitable for use in salt or sea water, as, obviously, salt deposits on the piston or valves would tend to pre-ignition and other troubles which must be avoided in large oil engines. While certain shipbuilders and ship engine builders will naturally desire to build their own oil engines forthwith it is to be hoped that for a year or two they will decide to purchase standard models and gain experience before attempting to build an oil engine themselves. It is surprising how many entrants to the field of gas and oil engine building who, having wonderfully novel ideas and also strangely wonderful engines, have, after lengthy experiments and much expense, arrived at the end of their voyage of discovery, finding that they had reached that point of experience where the established builders left off fifteen or twenty years ago. Moreover, the profits on building oil engines will be found to be considerably below those obtainable on steam engines, and it would appear extremely desirable from this point alone to avoid journeys into the desert of exploration. The author has not in this paper traversed the elementary stages of oil engine operation, as, in principle, they are largely similar to those gas engines and oil engines which have been so frequently discussed at the meetings of this Institute, but has desired to make prominent the most vital innovations of the systems described, so that at this juncture the cardinal points of the various systems may be reviewed by marine engineers.

Many questions have been raised as to the lubrication costs of the most approved engine, but, under ordinary circumstances and provided a suitable lubricant is used, there will not be found great difference under this heading between oil engines and the marine steam engine, including auxiliaries in both cases. With reference to the auxiliaries this is generally a 20-30 or 50 h.p. small engine ; in the high-powered units there are usually two auxiliary marine engines. These are employed to charge the various air reservoirs used for starting or reversing, and also (when compressed air is used) for operating the deck winches, otherwise the main engines have their own reservoirs which they charge themselves, for all the normal requirements of fuel injection and starting. The critic may here remark that, under certain conditions, if the auxiliary engine failed there might be difficulty in getting the main engines away or reversed. Admitted there might be such difficulty, but methinks the critic might be asked if, under certain conditions, his reversing engine employed on the present marine engine failed, would not that also be awkward. The critic might reply that such a thing would be extremely remote ; the author's reply *re* the auxiliary engine is ditto. An auxiliary engine is indispensable ; to rely entirely on the main engines keeping up air supply for all purposes cannot seriously be considered for marine work, and without these would be almost the equivalent of a steamer without the ballast or little donkey.

Much trouble was encountered in the early stages of marine oil engine building when many engines were reluctant to start on first admission of the compressed air and also through various faults in design. Moreover certain builds of the stationary type of engine were extremely troublesome to get away, when in the locality of humid or cold atmospheric conditions, but these occurrences are not a feature of the later production if properly handled. For instance, it would not be reasonable to expect that an engine will start with the main fuel valve choked up or with leaking valves. Now, as to the

question of wear and tear this may probably be slightly higher than with steam, but as it is impossible to have steam engines without boilers, and as the latter put up the repair bill considerably, the oil engine is in the long run considerably under steam in repair costs. Accidents caused by burst air reservoirs are extremely rare, and it must be recognised that, whether your motive power be steam, gas or oil, accidents in some form or other will occur, and under all ordinary conditions there is far less risk of explosion than with steam engines and boilers. Generally the author's opinion is that the greatest success will attend the installation of oil engines in boats, providing that ambitious schemes are not launched without mature experience, and at the onset moderate powers be used —say, 1,000 to 1,500 h.p.—so that the units can be gradually increased in size as experience is gained by the marine engineer in running and sea-going conditions. There are also many advantages to be gained by a trial of two small units instead of one large one, quite irrespective of the convenience

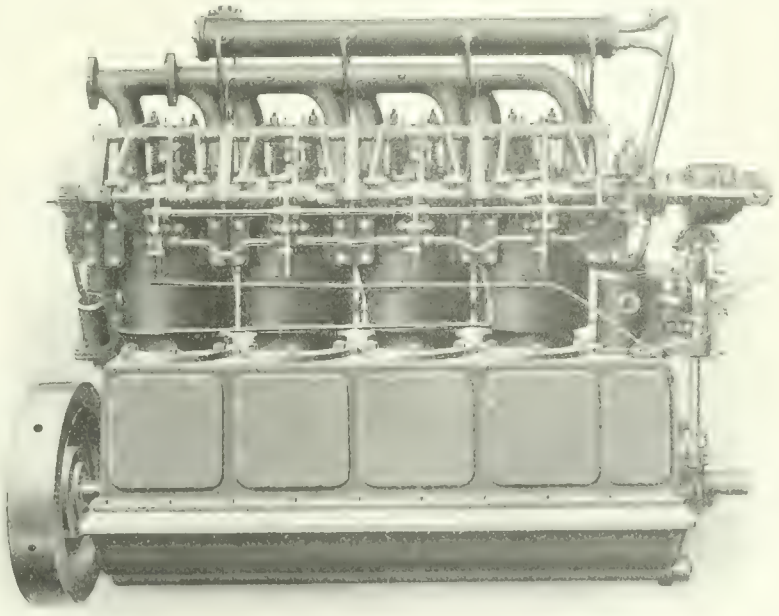
Fig 10.



Blackstone Marine Oil Engine.
Side elevation.

in inspection, ease of replacing parts, overhauls, etc., than if in one unit. If desired, however, one large unit may be installed with good results, and where the expense of two propellors cannot be considered. In the building of gas and of oil engines, many engines have been evolved which, after trial in the test shops, have been relegated to the scrap heap, an expensive process, but the only way if it is desired to send out a survival of the fittest, and new entrants into the field of marine oil engine building cannot expect to escape the same process in the initial stages. The Nuremberg and Sulzer engines are extremely well built, and it may be mentioned that the M.A.N. original engine is still at work and in excellent condition. The repair and upkeep of Diesel engines built by reputed makers have been much discussed, but there can be no doubt that they are superior in this respect to all other types of gas or oil engines. The point not to be overlooked in this connection is that the wear upon the piston and cylinder, which occurs in gas or oil engines of the usual type, due to high temperatures, shock, unequal expansion, etc., is largely absent in the Diesel, in which pressures are more or less constant.

The question of reversibility in the latest type of oil engines has been much discussed, and it will be easily understood that, as they are principally of the two-cycle type, on the engine being brought to a standstill, or on slowing down, compressed air being admitted at the proper moment, duly determined by proper admission valves, the method of operation, engine piston working proceeds the same, irrespective of the direction of rotation, *i.e.*, ahead or astern. The two-cycle engine obviously has the advantage over the Otto or four-cycle engine in the elimination of valves, and the value of this becomes particularly apparent in marine work. There is, however, no reason why the two-cycle principle should not be applied to a gas engine using producer gas, and the much discussed question of reversibility settled in this direction. The author however, may say that while producer gas may be used on a two-cycle engine he has every reason to believe that a new phase of difficulty will arise in connection with such engines as it is not necessary to discuss in this paper. Largely, however, there is no novelty in the two-cycle engine, but merely the exigencies of development in this direction have brought the more advanced method of using the cycle to a head. The practical pioneer of the two-cycle engine was, without doubt, Day, the inventor of the engine which bears his name.



Blackstone Marine Oil Engine.

Dugald Clerk says: "The Day engine has the peculiarity that it can run in either direction. This is possible because of the absence of timing valves or valve gear operated from the crank shaft."

In conclusion, the author hopes that criticisms will be focussed on the main features of the engines dealt with so that the solid objection from marine engineers to the oil engine may be brought out; and objections there will be, but, come as they may, the survival of the fittest cannot be obscured. Assuming that the marine engineer has studied his engines and is prepared to devote that same skill and diligence which he devoted to the marine steam engine the troubles of operating marine oil engines will speedily adjust themselves. The human element is a factor in all engineering matters, and it is apparent that if our engineers are not developed *pro rata* to the engines there must be an end of progress. While it cannot be expected that the veterans of steam propulsion will welcome the arrival of any form of internal combustion engine, it is certain that the younger generation of marine engineers are ready

to fall into line in the matter. An advantage also not to be overlooked is the rapidity with which a vessel can get under way. Except under special circumstances steam would not be raised in an ordinary boat from cold in less than six to eight hours, whereas the oil engines can be easily started in less than half an hour. Another feature also with steam which has not been touched upon is that at dead slow to half speeds the fuel consumption goes up considerably, and it is quite feasible to understand that during such an operation as docking the efficiency may be reduced from 25 to 40 per cent. While efficiencies and low fuel consumption can be maintained it would prove exceedingly interesting to have some authentic data on jobs not exceeding 1,500 h.p. which would show that the fuel consumption was considerably under 1½ lbs. per i.h.p., the same to be spread over a period of, say, two years, trial trips not counted. In the matter of coaling also, where extreme rapidity is desired, it is more than human to expect that a marine engineer, in addition to his numerous other duties, can check every ounce that is placed aboard of coal, and owing to various conditions there is occasionally considerable leakage. In one case the author has in mind where the fuel has to be sent a considerable distance before reaching its ultimate destination; the loss is between 5 and 7 per cent. from this cause. Oil fuel, on the other hand, can be accurately measured.

In this paper it is not proposed to discuss the auxiliaries, etc., where another huge saving is to be accomplished. There is every reason to believe that cases of broken propeller shafts and damaged propellers will be greatly minimized with the installation of oil engines, as the latest type oil engines are fitted with a rapid acting governor so that racing is not allowed to any extent or is absent altogether. While the latest type of oil engine is fairly elastic it would not be claimed that it has the advantages of steam at extremely low speeds, but it could be hardly considered a very serious objection. As a comparative example of the class of steam engines an illustration of the latest Sulzer uniflow steam engine will be found and although these engines are capable of giving 1 i.h.p. on 10 to 11 lb. of steam per hour, they have been found to be totally unable to compete with the oil engines of the same make. While the oil engine does not lay claim to have the great elasticity of the steam engine, the author would remind critics that neither does the oil engine have the "elasticity" of fuel consumption on varying loads in anything like the same proportion that is encountered with steam engines under similar circumstances. The consistency of the oil engine in fuel consumption is one of its marked features, and it is well-nigh impossible for any marine job to work to a fuel consumption having such small variations. Almost throughout the world liquid fuel oil is becoming now available, and such being the case the equivalent ½ lb. of the same gives the 1 b.h.p. When the oil engine is settled down to marine work the author is confident that differences of fifty, one hundred and two hundred tons variety in consumption on round trips will be a thing of the past, bad weather conditions reckoned upon.

Recent information to hand shows that fifty vessels, ranging from 1,000 to 9,000 tons, are afloat or under construction.

Messrs. Leonard Chapman & Co., Ltd., Importers and Manufacturers, Munton Road, London, S.E., report:

Graphite, as imported, according to quality.

	£ s. d.	£ s. d.	
Ceylon L.L. c.i.f. London	15 15 0	to 38 0 0	per ton
,, O.L. ,,	10 19 6	to 37 19 6	,,
,, chips ,,	8 15 0	to 27 10 0	,,
,, dust ,,	10 0 0	to 25 10 0	,,
Purified, milled and ground.			
Ceylon, 97% to 99%, f.o.b. London	50 0 0	to 63 0 0	per ton
,, 95% to 97% ,,	40 0 0	to 42 0 0	,,
,, 85% to 87% ,,	30 0 0	to 32 0 0	,,
,, 70% to 71% ,,	27 0 0	to 28 0 0	,,
American large flake, f.o.b. London	45 0 0	to 49 0 0	,,
,, small ,,	35 0 0	to 45 0 0	,,
Joint Compd. per cwt.	2 9 0	to 2 12 6	
Paint Paste ,,	2 2 0	to 2 5 0	
Paint ,, per gall.	0 4 0	to 0 5 3	

Wholesale lists of tinned goods on application.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our Own Correspondent.)

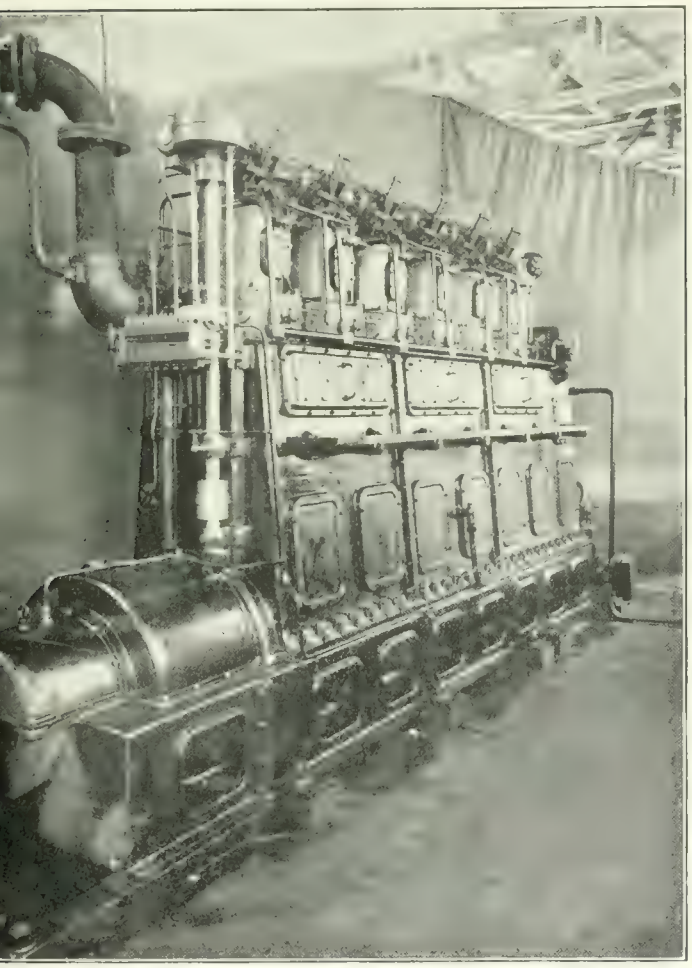
Portsmouth Dockyard.

ONE of the new armoured ships has been allotted to Portsmouth, and the sum of £182,000 is to be spent on the vessel during the coming financial year. Whether she is to be a battleship or an armoured cruiser of the "Invincible" class is not yet settled, but doubtless she will be a battleship. The large refits provided for are the cruiser *Drake*, which is to have over £100,000 expended on her; the cruiser *Argonaut*, £91,042; the battleship *Albemarle*, £18,000; and the cruiser *Essex*, £11,780. The new battleship *King George V.* is to have over a million sterling spent on her during the year. The vessel is making very satisfactory progress and her framework has been advanced to a fairly large extent. The launching ceremony will, according to present arrangements, take place in August. The progress of the battleship *Orion* is also satisfactory, and there seems no reason why she should not be ready for her steam and gunnery trials by June. The battleship *Neptune* has returned from the Mediterranean and has been placed in dry dock for a final clean up preparatory to becoming the flagship of the Home Fleet. The change of Admirals took place on March 25th, when Admiral Sir Francis Bridgeman hoisted his flag in succession to Sir William May, who goes to Devonport. The old flagship, the *Dreadnought*, is to undergo her first extensive refit. The armoured cruiser *Invincible* has arrived for a thorough overhaul in consequence of her electrically-worked barbettes still giving trouble. The vessel will be ready to take part in the Coronation review, which, it has been announced, is to take place on June 24th, two days after the coronation of their Majesties in Westminster Abbey. The fleet to assemble at Spithead will, it is understood, be a record one, and it is probable that in addition to the four divisions of the Home Fleet and the Atlantic Fleet, part of the Mediterranean Fleet will be present. The cruiser *Achilles* was to have come in for refit on April 1st, but her repairs have been deferred until the end of July owing to the large amount of work in hand. The port has been in mourning owing to the sudden death, on March 1st, of Admiral the Hon. Sir Assheton Curzon Howe, who came here as Commander-in-chief less than a year ago. He has been succeeded by Admiral Sir Arthur Moore, who was last employed as Commander-in-chief on the China station, which post he vacated at the beginning of 1908. Engineer-Captain Frost, who is on the staff of Rear-Admiral Limpus, commanding the local division of the Home Fleet, has been awarded a Good Service pension of £150 a year, in the vacancy created by the promotion of Engineer-Captain Fielder to Engineer Rear-Admiral.

Devonport Dockyard.

We have been allotted one large armoured cruiser, for which the sum of £171,000 has been allowed for the new financial year. Just over a million is to be spent on the *Centurion*, and about half that amount on the *Lion*, while the large refits include the cruisers *Sutlej*, *Amphitrite*, *Europa* and *Andromeda*. The battleship *Collingwood*, as mentioned last month, came in for docking in consequence of having struck a rock when entering Ferrol Harbour. An examination of her underwater plating showed that it is damaged over a space of about 120 square feet close to the oil tanks and 12-inch magazine. The plating damaged is approximately 25 feet in length and only 4½ feet in width. Another vessel belonging to the port met with a mishap recently, the battleship *Mars* colliding with a schooner while on her way from the Hamoaze to her berth in the Sound. The battleship's ram struck the schooner on the starboard side, and to prevent the small vessel sinking she had to be beached. The battleship was uninjured, it is almost unnecessary to add. The destroyer *Acorn*, of the Second Flotilla, came in on March 8th in a damaged condition, having been in collision off the Scilly Isles with the *Redpole*. Both are new vessels and have only been recently delivered. The *Acorn*, which came in under her own steam, had a large hole on her starboard quarter, while the *Redpole* is said to have been uninjured.

Another collision occurred on March 10th, about two miles off Rame Head, between Submarine *B6* and a ketch, while the submarine flotilla was exercising. The ketch was slightly damaged and came into port, but the submarine was none the worse. The cruiser *Lion*, which has been in dock for over six months, has been floated into the basin, where her armament, tripod mast, funnels, turbines and conning towers will be lifted in. The cruiser *Gloucester* has reshipped her foremast, which carries the range-finding equipment, it having been taken out for repair owing to defects developed during the recent exercises. The cruiser *Talbot* has returned from her trooping trip to the Mediterranean, and has been sent to Haulbowline for a refit. The value of the extension of No. 4 Dock at the South Yard, which was only recently completed



M.A.N. 300 to 1000 H.P. Reversing Nuremburg Marine Oil Engine.
(See "Modern Developments in Oil Engine Practice")

has already been proved on two occasions, when pairs of destroyers have been simultaneously docked. The pair in dock now are the *Vigilant* and *Bullfinch*. An outbreak of fire occurred on the night of March 11th in the wireless room of the destroyer *Goldfinch*, which was lying alongside a wharf, all the fittings and instruments being destroyed. The *Goldfinch* was only delivered just over a week previously, and she had been commissioned for the Second Destroyer Flotilla. Admiral Sir William May is to be Commander-in-chief in succession to Admiral Sir Wilmot Fawkes, and he is to take up his duties on April 9th. It is anticipated that Admiral May will only remain at the port until next spring, when he will probably go to the Admiralty as First Sea Lord.

Chatham Dockyard.

It cannot be said that we are disappointed at our share of new construction as set forth in the Navy Estimates, as no one really expected that we should be allotted a large vessel. Our share is, as anticipated last month, two submarines, on which £16,000 is to be expended during the coming financial year. The amount allowed for the new cruiser *Chatham* is over £200,000. That vessel is making excellent progress. The principal work in the repair programme are the refits of the battleships *Bulwark*, *Canopus*, *Glory* and *Ocean*, and the cruisers *Cressy*, *Hyacinth* and *Dido*. There is also the cruiser *Pactolus*, which was withdrawn from sale at Sheerness three years ago and laid up in the River Stour. She is to be brought here and converted into a depot ship for submarines at a cost of £11,000. The two submarines of the programme of 1910-11, whose keels were recently laid, are to be known as the "E" class. They will be 176 feet long, with a maximum breadth of nearly 23 feet and a displacement when submerged of nearly 800 tons. As showing the progress made in this direction it may be mentioned that the "C" class, the first submarines built here, are 135 feet long and their displacement 320 tons. Two vessels of the "D" class are in hand, *D7* and *D8*, one of which is in an advanced state, while the other will be completed in a few months. The first salvage vessel for submarines, *Lighter No. 94*, which has been built here, has been delivered at Sheerness, where she is to be stationed. The vessel has been specially constructed to lift submarines of the "C" class, and will be used for mooring work until required for salvage operations. The tugs *Firm* and *Alliance* have also been completed and manned by Sheerness crews. The *Firm* is to be attached to Dover in place of the *Rambler*, which has been sent to Gibraltar. She is a paddle tug, with a displacement of 690 tons and engines of 1,250 horse-power. The *Alliance* is a screw vessel with a displacement of 620 tons and is fitted with engines of 1,400 horse-power. She is for service at Sheerness. The battleship *Agamemnon*, of the First Division of the Home Fleet, which recently touched an uncharted rock in Ferrol Harbour, has come in to be docked, but it was found that the injury she sustained is of a very trifling character, such as a bent plate and some little damage to the framework. The repair ship *Cyclops* is due immediately for a refit. The destroyer *Derwent*, which had been in hand for nearly three months, has been recommissioned for service in the Nore Flotilla. Engineer Rear-Admiral Rudd, who had been manager of the engineering department since the beginning of 1906, has been placed on the retired list after thirty-nine years' service. His successor is Engineer-Commander Rawlingson, from Gibraltar, who, like his predecessor, has passed the special courses at the Royal School of Naval Architecture and the Royal Naval College, Greenwich.

Sheerness Dockyard.

Reference has previously been made to the reorganization of the Nore Destroyer Flotilla. The Torpedo boat Flotilla is also being reorganized by removing the old boats and replacing them by the turbine boats which have been in the destroyer flotilla, these latter having been originally designated coastal destroyers. The *Ribble* has been detached from the Nore Destroyer Flotilla and sent to Haulbowline for a refit. The cruiser *Highflyer* left at the end of last month for the East Indies to relieve the *Hyacinth* as flagship. The latter vessel is to return here and join the Nore Division of the Home Fleet. The cruiser *Blenheim* arrived on March 6th from Chatham on the conclusion of her refit, and a few days later proceeded to Harwich to resume her duties with the First Destroyer Flotilla. While entering Harwich Harbour the *Blenheim* grounded, but was floated uninjured at high tide. Submarine *C9*, which was damaged by colliding with Hartlepool breakwater, will have to be fitted with a new bow casting. The vessel has been moved from the dock into the steam basin, where repairs are being carried out to her electric batteries, pending the delivery of the new casting from Messrs. Vickers, Sons & Maxim, the builders of the vessel. The destroyer *Hasty*, which was escorting Submarine *C30* to Dundee, met with an accident to her rudder off Great Yarmouth on March 16th. She was brought in for repairs by the tug *Robust*. A collision took place in the harbour on March 9th, but luckily without serious damage. The *Urgent*, a recently-built water tank, was caught in the ebb tide and drifted across the bows of the cruiser *Endymion*,

receiving some damage on the port side amidships. She was brought in and docked, when it was found that a small portion of her bilge keel had been carried away and a hole had been made. A sad mishap occurred towards the end of last month while Torpedo Boat No. 115 was picking up moorings. A seaman slipped off the buoy and Lieutenant-Commander Alderton jumped into the sea and endeavoured to save him, but lost his life in the attempt. The seaman was rescued. The dredging operations which have been in progress for some time past in connection with the adoption of a new channel for warships have been completed. The old channel where it crossed the bar had only 20 feet of water at low water spring tide, but there is believed to be not less than 27 feet in any part of the new channel.

Pembroke Dockyard.

It was found necessary to postpone the launch of the cruiser *Active*, which had been arranged for February 27th, until March 14th, when the event duly took place in the presence of about 5,000 spectators, the naming ceremony being performed by Lady Herbert, the wife of Major-General Sir Ivor Herbert, M.P. Practically all the main fittings in the after part of the vessel were completed, with the exception of the propellers, which will be shipped when the vessel is in dock. A departure has been made in the *Active* as regards the berthing of the officers and crew, the old custom of accommodating the officers aft and the men forward being reverted to instead of as in the four previous vessels of the class, where the officers are quartered in the forecastle and on the lower deck forward and the men aft. The *Active*, it is understood, is intended as a parent ship for destroyers, like her sister vessels. Immediate preparations were made after the launch for laying down the cruiser *Amphion*, this event taking place on the following day, when Mrs. Mundy, wife of the Captain-Superintendent, performed the ceremony. The *Amphion* will be practically a replica of the *Active*. The cruiser *Blonde* has completed her steam and gunnery trials in a very satisfactory manner and she is now being prepared for commissioning. The horse-power was easily kept above the stipulated 18,000, and sometimes reached 23,000, while she attained a speed over the measured mile of 25·73 knots. The confident anticipations as to two unarmoured cruisers being allotted to Pembroke have not been fulfilled, our share being one unarmoured cruiser, on which £77,000 is to be spent during the coming financial year. Still, we have the cruiser *Amphion*, on which a start has just been made; the *Active*, just launched, and the *Blonde* to complete for sea, in addition to repair work. So no doubt there will be quite enough work to keep us fully employed during the year. The destroyers *Cheerful* and *Coquette*, which are undergoing refits, have been dry-docked, and when they leave the dock Torpedo Boat No. 045 will be taken in hand. This boat recently underwent an extensive refit at Devonport, when new boilers were fitted and a considerable part of the outer bottom was newly plated. The principal thing we have to do is to remedy the deficiency of water tanks.

MARINE BOILER REPAIRS.

AT the Institute of Marine Engineers, the adjourned discussion took place recently on the paper read by Mr. James Innes, entitled "Notes on Marine Boiler Repairs."

In opening the adjourned discussion Mr. H. Ruck-Keene supported the author's statement that corrosion in the upper part of the front-end plate was due to radiation of heat from the uptake and the plate being subjected to continual wetting and drying through the pitching of the vessel. With regard to the corrosion often found in the bottom manhole doors referred to in the paper, a good many repairs in cases of this kind had been carried out very successfully by means of the oxy-acetylene and electric systems of welding. Corrosion in the way of the feed-check valves was almost entirely due to the amount of air passing through the valve. Furnace cracks were in most cases due to accumulation of scale at one particular part of the furnace. He strongly advocated withdrawable furnaces, and described a method by which they could be fitted where ordinary furnaces had originally been used.

Mr. Robert Balfour emphasised the importance of adequate boiler seatings to prevent leakage, grooving or cracking of the circumferential seams due to want of support. Grooving and cracking of the furnace front plates flange to which the furnace is riveted at the top part was found in most cases where rigid furnaces of ribbed or plain type were fitted. When the bottom part of the furnace front plates was badly corroded, necessitating renewal, the practice was to cut the plates at the sides between the furnaces at places sufficient to admit of the fitting and riveting of the internal butt straps to the new and old plates. In some cases lap joints had been adopted. He considered that corrosion of furnaces along the line of the fire bar was due to the freeing of the air from the water and difference in temperature at this level, when rapid ebullition took place. It was a question of treatment and should be arrested in time. The distortion of furnaces in his opinion was often due to bad circulation, limited power, forcing fires and inferior coal. With regard to cracks in furnaces, he preferred either the oxy-acetylene or electro-thermic systems of welding to lock studding.

Mr. F. M. Timpson referred to the great care with which the boilers were looked after by marine engineers generally. He mentioned a case where, in a land boiler, a pipe was fitted from the blow-down cock to the back of the boiler to clear away the accumulation of sludge, and thought this method might be applicable to vertical donkey boilers where occasionally deposits were to be dealt with.

Mr. A. Jobling did not consider the buckling of the back plates was due to the accumulation of scale, as in several cases which had come under his notice their predominant feature had been the accumulation of scale, yet there was no buckling, while with practically clean boilers the backs had been buckled. He suggested that it was due to bad circulation in many instances.

Mr. S. J. Ross said that in his opinion many of the troubles mentioned in the paper arose more or less from defective circulation of the water; for instance, it had been proved from experience that the fire-box stay nuts did not burn off when the circulation was good. Corrosion also would be prevented, as the corrosive elements in the water could not act if the water was kept circulating.

Mr. H. Schofield considered that corrosion in the line of the firebars could be prevented by improving the circulation.

Mr. T. R. Stuart did not think that the want of circulation had any effect in the corrosion on the line of fire bars. The corrosion took place chiefly in ships not fitted with feed heaters, and was effected principally by the admission of air into the boilers. The leakage between the feed pipe and the checks, in his opinion, could be prevented by placing the feed check valve in a more convenient position on the front on the shell of the boiler. All water should be evaporated before being put into the boiler.

Mr. J. Thom considered that riveted seams were the cause of many leaks in boilers. He did not think the question of circulation was of much importance; the exclusion of any oil from the boiler was more vital.

Mr. R. S. Kennedy described some repairs effected by the electric arc system of welding.

Mr. E. W. Ross mentioned an improved way of building a boiler in which the shell-plates were rolled circumferentially, and welded into one piece to avoid riveted seams.

Messrs. W. Forrester and J. Clark also took part in the discussion, and the meeting concluded with a vote of thanks to Mr. Innes on the proposal of Mr. Timpson, seconded by Mr. Clark.

A RECORD FEAT IN SALVAGE WORK.—The Burn Line steamer *Bannockburn* recently came into collision with the steamer *James Westoll*, and, being in danger of foundering, was beached at Dover near the Prince of Wales' pier. The Dover Harbour tug *Lady Crundall*, which is fitted with powerful Merryweather salvage pumps, was taken alongside and pumped out the water from the damaged vessel, enabling her to return to London for repairs. The *Lady Crundall* has accomplished many excellent performances, notable among these being the salving of the British cruiser *Sappho* and the New Zealand liner *Whakatane*, but it is doubtful whether she has done smarter work than on the present occasion. Twenty to thirty thousand tons of water were pumped out of the *Bannockburn* within twenty-four hours.

OBITUARY.

Alexander MacLaine, J.P.

BY the death of Mr. Alexander MacLaine, J.P., which occurred at his residence, 1, Queen's Elms, University Road, Belfast, on the 24th of February, a link connecting the old wooden shipbuilding period in Belfast with modern shipbuilding, has been severed. The deceased, who had been in a feeble state of health for some time past, had reached the advanced age of eighty-eight years. Although for the past two or three years Mr. MacLaine had taken no active part in business affairs, he was at one time prominently associated with the industrial and commercial life of Belfast. For a period of thirty years he occupied the position of Chairman of the Ulster Steamship Company, of which he was one of the founders. He was also at one time director of the Belfast Steamship Company and of the Ulster Marine Insurance Company, and for some years he was a member of the Harbour Board and of the Chamber of Commerce. Mr. MacLaine's father, who was a native of Skye, came to Belfast upwards of a century ago, and, in partnership with the late Mr. William Ritchie, carried on a successful shipbuilding business. On Mr. Ritchie's death, Mr. MacLaine, senior, became sole proprietor of the yard, subsequently taking into partnership his sons John and Alexander, and the industry was carried on by them until the year 1878, when the business was absorbed by Messrs. Harland & Wolff. The deceased patented a piston packing which met with considerable success, both in land and in marine engines, and is still being extensively fitted. He was one of a family of five brothers and three sisters, of whom the only survivor is Mr. George L. MacLaine, the highly-esteemed Clerk of the Crown and Peace for County Down. It is interesting to note that Messrs. MacLaine and Sons were the last local builders of wooden ships, and they are said to have turned out the first steamship built in Ireland.

James Thomson.

Many of our readers know and will remember well the late retired Superintending Engineer of the Pacific Steam Navigation Co., whose death, we have to record with regret, took place on March 4th. Mr. Thomson served for some years as engineering manager with Messrs. John Elder & Co., Glasgow—the Fairfield Shipbuilding & Engineering Co., Govan, being the modern name of the firm. During the years of his management of the works the Pacific Steam Navigation Co. had several steamers built and engined by the firm, and the association led to his appointment in 1881 as superintending engineer of the Company. Being more closely associated with Liverpool, especially during more recent years, Mr. Thomson was better known on the Mersey than the Thames, but many of his old friends in London will learn with regret of the passing away of one with whom they were familiar when the Pacific Navigation Co.'s steamers were using the Royal Albert Dock and Tilbury. Mr. Thomson retired from the active superintendence of the Engineering Department of the Company some six years ago, but retained a connection as consultant.

William I. Taylor.

We regret to announce the death of Wm. I. Taylor, the London marine representative of the Darlington Forge, who succeeded the late Arch. Thomson in this appointment some years ago. Mr. Taylor served his apprenticeship as an engineer with Messrs. Losh, Wilson & Bell, Walker-on-Tyne; continuing with this firm for a few years, he became draughtsman. Subsequently he was engineer-manager for a colliery in the north of England, afterwards obtaining a post with Messrs. Clarke, Chapman & Co., the well-known Gateshead firm. He was later appointed London representative of the firm, and held that position for about twenty-five years, and during recent years he also held the position of a Director. A few months ago, negotiations were opened which led to his severance from the firm he had been so long associated with. He still continued to act for the Darlington Forge till the date of his death, which occurred, at the age of 62 to 63, on March 10th. Mr. Taylor was for many years a member of the council of the Institute of Marine Engineers, and was a member of the Institution of Mechanical and of the Electrical Engineers.

CORRESPONDENCE.

We do not hold ourselves responsible for the opinions expressed by our correspondents.

To the Editor of The Marine Engineer and Naval Architect.

Re Steam Piping Arrangement on the Induced Circulation System.

Dear Sir,—May I submit to you and to your readers some results of a search for a means of separating steam from water, so that any engine or apparatus may be supplied with dry steam when working, and also when at rest, have dry steam in readiness to put it in operation.

When from the plan of piping, insufficient outlet, downward bends, drains being too small or unsuitably placed, water obstructs the passage of steam, the steam bursts through explosively, resulting in water hammer and attendant evils. Confusion of steam and water, which is destructive to pipes, joints, cylinders and packings and opposed to efficiency, occurs when either the steam or water are compelled to go where they have no natural tendency to go. The key to the construction of a system of piping by which steam goes to the engines and water of condensation returns as feed to the boilers, and which I would advance as *a principle in the action of steam*, is this—*Steam flowing through a horizontal pipe across the lower orifice of a vertical pipe closed at the top induces upward and downward currents of steam in the vertical pipe.* In inclined pipes connected to a horizontal main through which steam is flowing, there are upward currents along the top and downward currents along the lower internal surfaces. The speed of these currents varies with the speed in the main and the angle of incline of the branch pipe. In a horizontal branch pipe connected to a main of flowing steam there is only slight circulation at the end so connected. Steam will enter, condense and hang in such a pipe. In a branch pipe below the horizontal line from the main there can be no circulation. Live steam entering does not return but is reduced to water if not used or let out at the lower end. This pipe becomes full of water and may contain ice, while steam flows along the main above it.

In some experiments with pipes substantially vertical the steam was of 165 lbs. pressure per square inch in the case of an exposed pipe about 50 feet above the main, and 180 lbs. with one 65 feet above the main insulated with asbestos, canvas and paint. When the valve at the top was opened in either case, after having remained closed for days, the steam was so dry that it was quite invisible when first issuing and no water could be perceived. The results were identical with the naked pipe and the well-covered one. Radiation and condensation did not cause the downward flow. Currents which attend upon radiation and condensation for their motion would be comparatively slow and there would be drops of water trickling down inside the pipe, and on the valve being opened some water would be blown out. It is my opinion that the action in vertical pipes is a quick and continuous eddy at the entrance, inducing upward and downward currents, that this eddy is aided by a natural property of steam, *a fluid the fresher and lighter of whose particles successively seek the highest points in the containing vessel, displacing those less fresh and light.* (Does not this point to a simple cylinder for a superheater? The hottest live steam would rise spontaneously to an outlet at the top without being baffled and tortured through or past pipes or plates. Steam traps and drains would not be necessary on steam piping.)

It was noticed that drops of rain or sea spray striking the naked vertical pipe were instantly vapourized—that a sea washing over it at about 20 feet from the top caused a cloud of vapour, the pipe becoming dry directly after the sea had passed, and that in rough weather during which sprays frequently washed against it, the pipe became encrusted with a hard scale of lime and salt up to three-eighth of an inch thick.

In a horizontal main steam pipe having a sufficient outlet the hottest and lightest steam will rise to the top, moist steam below this and water, if any, will be urged along the bottom of the pipe, at a slower speed, by the friction of the steam above it, probably in waves as when wind-driven.

The outlet should be at the end of the main, at the greatest distance from the boilers measured along the pipe. I would make the outlet valve at least one-third the area of the main, open it fully before turning on steam and regulate it afterwards according to requirements. It would supersede all drain cocks on the system of piping.

No attempt was made to try the temperatures inside the various pipes, and as tests of the outside temperatures were only made for comparison and by rough and ready means, I give only the main facts without figures. The temperature of branch pipes inclined very slightly upward from the main, was higher along the top than the bottom, the difference being greatest when the speed of the main current was decreased by the outlet being nearly closed. Naturally also the temperature along the top of the main was higher than that of the underside, and the difference greatest at the outlet end, because of the presence of water.

It may be, therefore, inferred—

1. That dry steam is obtainable for every engine, either to work it or to keep it in readiness, leaving only cylinder condensations to be dealt with by drains and relief valves.

2. That by placing the main supply pipe below the level of engine stop valves, carrying it past them and there fitting an outlet valve, all condensations will be drained from the pipes leading to such stop valves as well as from the main.

3. That each engine by using steam increases the speed, the quantity and therefore the freshness of the steam passing through the main and branches between it and the boilers.

4. That rapid circulation may by this method be induced in vertical branch pipes, less rapid circulation in those inclining upward from the main, very little circulation in horizontal pipes and none at all in those below the horizontal line. Therefore, wherever possible, steam pipes should be constructed to branch upward from a main and not horizontally or downward.

A few instances in which the induced circulation system indicated may be applied.

1. In the case of the main engines of a warshp or merchant steamer the steam pipe after passing below a short vertical pipe or tee-piece, which leads to the intermediate stop valve may be bent downwards towards the condenser and reduced in size. A suitable valve with rod to the working platform and a cock on the condenser could be fitted and used as a silent blow-off on any sudden stoppage or reduction of speed. Any water in the main steam pipe would, whether the engines were in motion or not, be driven along the bottom of the main past the vertical pipe or tee-piece and would fall into the pipe leading to the condenser. The best of the steam would rise and circulate in the vertical pipe until the stop valve was opened.

2. Feed, circulating, ballast and other pumps and auxiliary engines in the engine-room may be similarly supplied, the pipe or main from boilers being first brought below the level of the lowest stop valve, the outlet steam and water being made use of in feed water heater, feed suction pipe or hot-well.

3. Winches and other deck machinery might also have branch pipes leading to their stop valves from a main below them. There should be no horizontal branch pipes, sags or downward bends.

4. In refineries, distilleries and factories of all descriptions the use of the induced circulation system would result in increased efficiency and economy. The main could be led downward and horizontally. It would not be advisable to raise after once lowering. If laid on or below the ground or floor it can be incased and insulated, including flanges and necks, more thoroughly and at less cost than when carried overhead. Insulation is also to be recommended for branch pipes. Where these are of great length and the engines not continually in use, heat losses may be prevented by the use of valves placed between them and the main.

5. On the induced circulation system numbers of radiators, heater coils and the like, ashore or afloat, may be supplied with steam from one pipe with one inlet valve and one outlet valve—separate exhaust pipes are unnecessary and many fittings may be dispensed with.

Steam piping on the induced circulation system cannot be surpassed for efficiency, safety, economy of maintenance and, the principles involved, once understood, for simplicity of arrangement.—I am, Sir, yours faithfully, J. H. YATES.
Rotterdam, March 11th, 1911.

REVIEWS.

Directory of Merchants, Manufacturers and Shippers of the World for 1911. London: Kelly's Directories, Ltd.

The present edition is the twenty-fifth and the twentieth annual issue. The directory contains 3,200 closely-printed pages, of which the indices take up nearly 300. 1,800 pages relate to Continental and foreign places, one-sixth of which relates to British Colonies only, and there are 1,000 pages dealing with the trades of the Metropolis and the United Kingdom. 15,000 cities and towns in the Colonies and abroad are mentioned, while the trade classification index has reference to over 100,000 different places. It is obvious that by the use of this index it is easy to ascertain at once if any individual trade is carried on in any particular town or city. The names of over a million and a quarter different merchants, etc., are to be found in the directory, and, in addition to furnishing a guide to both the import and export trades of the world, the book contains much information not to be found in any other directory. The work forms a great undertaking and will prove of great service to those traders wishing to extend their foreign trade.

Sell's Directory of Registered Telegraphic Addresses for 1911. London: Business Dictionaries, Ltd., 166, Fleet Street.

The history of this directory has been one of constant growth until the present edition includes over 2,300 pages. In addition to 80,000 telegraphic addresses of the United Kingdom, it contains a list of trades, classified (100,000 firms), and 30,000 Colonial and foreign cable addresses. There are something like 3,000 different trade headings, under which are grouped important firms of the United Kingdom, an admirable list for obtaining estimates and quotations from the principal firms of a trade and for circularising. Telephone numbers of the firms are also included. A section of the directory gives Colonial and foreign addresses, corrected to date and new names added, no fewer than 100 pages having been added to this section in the present edition.

Engineers' Year Book, 1911. By H. R. Kempe, M.I.C.E., etc. Price, 10/6. London: Crosby Lockwood & Son.

The 1911 edition brings this work up to its eighteenth year of publication. It contains 1,356 pages and over 1,100 illustrations specially engraved, and is produced in its usual high-class style. The endeavour has been to render the present edition as complete and up-to-date as possible, and with this object in view a re-arrangement of the order of the various sections has been carried out, in order to bring them more in accordance with their connection with each other. Much new matter has been added and several sections have been rewritten or revised and extended, among which the following may be mentioned. Steam, Gas and Oil Engines, by Mr. W. H. Booth, C.E. Harbour and Dock Engineering, by Mr. A. Brysson Cunningham, B.E., etc. Naval Architecture and Marine Engineering, by Mr. Percy A. Hillhouse; and Lubrication, by Mr. J. Veitch Wilson.

Rhodes' Directory of Passenger Steamers, 1911. Price, 2/6. London: George Philip & Son, Ltd.

The entries in the twenty-fourth annual edition of Rhodes' Directory have been carefully revised and brought up-to-date by the addition of the names of new steamers. The directory still grows in favour and enjoys an increasing circulation. The present issue comprises 397 pages, in addition to 17 full-page illustrations of steamers which are placed at the commencement of the work. These are followed by a list of the shipping companies with their fleets, after which we have the alphabetically-arranged table of passenger steamers. The directory forms an excellent reference book for particulars of steamers.

BOOKS RECEIVED.

The Slide Rule. A Practical Manual by C. N. Pickworth. 12th edition. Manchester: Emmott & Co., Ltd.,; London, Whittaker & Co., Ltd. Price 2s. net.

To those who wish to learn how to use the slide rule to its greatest advantage this manual is indispensable. It is the best book written on the subject.

Logarithms for Beginners. By C. N. Pickworth. 3rd edition. London: Whittaker & Co. Manchester: Emmott and Co., Ltd. Price 1s.

This is the 3rd edition of an extremely useful work giving a simple and detailed explanation of logarithm and their uses illustrated by a number of worked examples.

Dictionary of English and Spanish Technical and Commercial Terms, By Wm. Jackson. London: E. & F. N. Spon. Price 2s. 6d. net.

Part 1 of the book contains the English-Spanish division, showing in column the English word first with its Spanish equivalent. In part 2 is included the Spanish-English portion. The dictionary has been compiled principally for the iron, steel, hardware and engineering trades, and should be found useful by those engaged in these trades.

The Gyroscope, By V. E. Johnson, M.A. London: E. & F. N. Spon. Price 1s. 6d. net. This is an experimental study of the gyroscope from spinning-top to mono-rail, and has been founded on a series of articles contributed by the author to the *Model Engineer,* but now revised and extended. It will be found very interesting reading

CATALOGUES RECEIVED.

Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W. Thumb index catalogue of their electrical machines.

The Electric and Ordnance Accessories Co., Ltd., Aston, Birmingham. A leaflet describing "Duralumin," an alloy for which is claimed the strength and hardness of mild steel, but only slightly heavier than aluminium.

Verity's, Ltd., Birmingham. Literature relating to their specialities—Fans, searchlights, projectors, arc lamps, etc.

G. M. Boddy & Co., London. New catalogue of "Phillip's" lamps.

J. F. Coates, Mosley Street, Manchester. 1911 catalogue containing full particulars of "Ajax" marine motors in sizes from 2 to 24 h.p.

Smooth-on Manufacturing Co., of Jersey City, N.J., have just issued a booklet of sixteen pages containing extracts from the Smooth-on Instruction Book. This book deals with all Smooth-on specialities and the company will be pleased to send the instruction book to any one who may desire it.

A PAINT, VARNISH AND ENAMEL REMOVER.

A NEW paint, enamel and varnish remover known as "Vanisho," has been recently placed on the market by the Vanisho Co., of 49, Bedford Row, London, W.C. It is stated to be non-inflammable, non-poisonous, non-injurious, and non-explosive; points in its favour which will no doubt recommend it. Many other advantages are claimed for "Vanisho" which we proceed to enumerate.

"Vanisho" forms a reliable and safe preparation for cleaning fronts of houses and monuments from dirt, paint and varnish, and does not cause any discolouration of iron or woodwork, as it contains no acid. It does not cause damage to either brush or cloth, neither is any harmful effect produced on the hands of those using it.

"Vanisho" will soften even the oldest paint in a few minutes and leaves not a mark on wood, stone or iron; it is also quite free from risk of fire or explosion. This new preparation does not evaporate or stick and can be washed off with water or scraped off with a chisel. It takes effect in about three to eight minutes after application, the time depending upon the thickness of the paint to be removed. "Vanisho" must not be allowed to dry on.

The preparation is sold in tins of one gallon, 7s. 6d.; half gallon, 4s.; quarter gallon, 2s. 3d.; one-eighth gallon, 1s. 3d. and four ounces, 6d.; no charge is made for the tins and full directions are issued to each purchaser.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(*From our Own Correspondent.*)

APART from the continued activity in releasing ships from the stocks, which but for the prolonged lock-out would have sooner been consigned to their "native element," and a moderately good influx of fresh work, the shipbuilding and engineering industries of the Clyde have been marked by one or two features of note during March. One was the launch of the largest merchant ship ever built at Greenock—the twin-screw 13,000 ton steamer *Medina,* for the P. & O. fleet—from the stocks of Messrs. Caird & Co., and the departure from the Clyde to undergo her trials of the battleship *Colossus,* the heaviest naval production which the Clyde has yet contributed to the nation's navy, and for which Greenock, and Scotts' Shipbuilding and Engineering Co. more particularly, are the claimants for honour. Fuller reference is made to the launch of the *Medina* further on in these notes. The *Colossus* left the dock of her builders on Saturday, March 11th, and after compass, adjustment and a preliminary spin on the Firth she coaled at the Tail of the Bank and with a navigating crew of some 400 hands left the Clyde for Devonport on the night of Tuesday, 14th, arriving in the south the day following. She is expected back in the Clyde again about 2nd or 3rd April.

Clyde Trust Dredging Plant.—The new dredging plant which the Clyde Trustees have decided to acquire, and for which tenders have been sent in by the dredger-building firms in Renfrew, Port Glasgow and Paisley, as well as by at least one firm outside of the Clyde, has not yet been placed. The offers have been remitted meantime to the Mechanical Engineers' Department for examination, but they will come before the Harbour and Workshops Committee later, and a recommendation will then be made to the Trustees for their consideration. One powerful dredger is to be built, and either four barges of 1,200 tons capacity each or three of 1,500 tons each.

Messrs. Fleming & Ferguson, Paisley, have contracted to build for the Irvine Harbour Trust a hopper dredger, estimated to cost £18,000. The vessel, which is to be delivered in eight months, will be built to Lloyd's highest class. She will have twin screws, and will be capable of dredging 400 tons per hour from a depth of 36 ft. She will have double the carrying capacity of the old Irvine dredger.

Messrs. Wm. Beardmore & Co., Ltd., Dalmuir, have received an order from the Adelaide Steamship Co., Adelaide, South Australia, for two steamers, of about 8,000 tons each, designed almost wholly for carrying passengers. They are completing the cruiser *Falmouth,* which they launched in September last, and they have on hand the *Dublin,* an improved vessel of the same class which was placed in January last, as well as the "Dreadnought" battleship *Conqueror,* the keel of which was laid in April of last year, and one of the 1910 destroyers of the "Standard" type, ordered in June of last year. At their Parkhead Steel and Ironworks, gun-making is now an established branch of work, all types of ordnance used in the British Navy, now being possible or actually under construction there, this special department having been inaugurated only about five years ago. The latest Admiralty order is for six 13·5 in. guns such as the nation's "Dreadnoughts" are now being equipped with. This latest order may be valued at over £70,000, will occupy about a year in completion, and will, with the other orders in hand, keep the Parkhead gun factory busily employed all the time. Messrs. Beardmore's armour-plate department is busily engaged at present completing last year's contracts.

Coventry Ordnance Works.—The branch of this Company's works, laid down some years ago on the north bank of the Clyde at Scotstoun, which were long inoperative, are now fully employed and already in process of enlargement. The works are used for the manufacture of some of the heavier and larger portions of the framework of the hydraulic barbettes for naval vessels, and for the final assembling and finishing of these mountings. Here there are a series of gun pits, each big enough to contain one of the largest barbettes complete after it is assembled. Hydraulic power is laid on,

and the whole mounting is erected and thoroughly tested in a pit before being sent to the vessel for which it is destined. The works include a large dock which will hold a steamer at any state of the tide. When the pit trials of a mounting are concluded, it is lifted bodily from the pit by large cranes and placed intact in a steamer for conveyance to the yard where the man-of-war is being completed.

Messrs. Russell & Co., Kingston Shipyard, Port Glasgow, have received an order from Messrs. Arbuckle, Russell and Co., Glasgow, for a steamer of 8,250 tons deadweight carrying capacity for delivery in September-October. Engines will be supplied by Messrs. Rankin & Blackmore, Greenock.

Messrs. Wm. Hamilton & Co., Port Glasgow, have received an order from Messrs. T. & J. Harrison, Liverpool, for a passenger and cargo steamer of 6,500 tons carrying capacity. Machinery will be supplied by Messrs. Dunsmuir & Jackson, Govan.

The Greenock and Grangemouth Dockyard Company have received from London owners an order for a steamer of 6,300 tons. The vessel, which is to be built in the Company's Greenock yard, will be engined by Messrs. Rankin & Blackmore, Greenock.

Messrs. Caird & Co., Greenock, who about the end of February received an order for two new steamers of the "Nile" class of 7,000 tons each from the P. & O. Company, had already on hand four vessels for the same company, *viz.*, two of the "M" class and two that were ordered for the Blue Anchor Line before it was taken over by the P. & O. Co. The two "M.'s" and the two "Niles" are for the intermediate services to India, China and Japan, and the other two vessels are for the Australian service. That one shipbuilding firm should have under construction at one time six large steamers for one shipping company is certainly noteworthy. This condition of affairs, however, has since been altered to some extent through the launch, on March 14th, of the largest of the vessels, *viz.*, the twin-screw mail and passenger steamer *Medina*. Besides being the largest vessel ever built at Greenock, this vessel is the largest, by about 2,000 tons, yet built for the P. & O. Line. She is, moreover, the thirty-sixth of the fleet to be propelled by twin screws, and is practically a sister-ship to the *Maloja* now being completed for the P. and O. fleet by Messrs. Harland & Wolff, Belfast. A feature of the vessel will be the elaborate installation of hydraulic cargo-working gear in the shape of cranes, etc., by Messrs. Brown Bros. & Co., Rosebank Ironworks, Edinburgh, as afterwards more fully referred to.

Messrs. Douglas, Primrose & Co., Glasgow, the Scottish agents for the Bolinders reversible engine, have received an order from East Coast of Scotland owners for a steel launch 42 ft. in length, to be fitted with machinery which will give a speed of 12 to 13 knots on Scotch crude oil costing about 2½d. per gallon. The engine will be of the direct reversible type and will be fitted with compressed self air starter.

Messrs. John Cran & Co., Leith, early in March launched a steel motor vessel 56 ft. long, 11 ft. 6 in. beam, and 6 ft. 6 in. deep, to the order of Messrs. Wm. Beardmore & Co., Dalmuir, who are supplying the internal combustion machinery. The vessel has been built for the Missions to Seamen Society, London, and is to be used for conveying the chaplains and lay workers to the shipping on the Thames. Messrs. Cran also launched a passenger steamer, teak built, 60 ft. by 12 ft. 6 in. by 5 ft 9 in., which is intended for the ferry service of the Londonderry Bridge Commissioners. The little vessel has been built from designs by Mr. A. M. Gordon, M.I.N.A., Glasgow, and will be fitted with machinery by the builders.

Messrs. E. G. Buchanan & Stevenson, Leith, who are the selling agents for Great Britain of the Edson system of wheel-steering gear, have received an order to supply this gear for the King's yacht *Britannia*. The Edson gear has been fitted to the German Emperor's yacht *Meteor*, and of recent years it has been adopted by a number of yachtsmen who are finding that once they get used to the wheel they can "feel" the boat just as well by it as by the tiller, and the wheel has advantages which the tiller does not possess.

Messrs. Brown Bros. & Co., Rosebank Ironworks, Edinburgh, whose large establishment is constantly kept busy producing their well-known specialities in the way of engine reversing gears, steering gears, telemotors, and hydraulic cranes and capstans are now installing in the P. & O. liner *Medina*, recently launched by Messrs. Caird & Co., Greenock, a very notable installation of hydraulic cargo-working machinery, similar to that just about completed on board the *Maloja*. These installations present the latest and best in this line. The hydraulic pumping engine, with accumulator, providing pressure for the working of the cargo and other gear is the largest and most powerful engine of this kind ever installed on boardship for the purpose. This is the makers' latest and most improved three-cylinder, three-crank, automatic compound type. There are three plain plungers or rams, each 4 in. diameter by 18 in. stroke. The associated hydraulic accumulator is steam loaded and has a diameter of 15 in. and a stroke of 5 ft. 4 in. The engine is fitted with its own surface condenser and a separate steam-driven combined circulating and air pump. The hydraulic pressure is 1,000 lbs. per square inch, and the steam 175 lbs., the engine being arranged to exhaust either into the auxiliary condenser or to the atmosphere. The great capability of the engine may be inferred from the fact that it is designed to put the whole of the ten cargo cranes with which the vessel is fitted—two of which are capable of lifting six tons with double purchase from the holds and swinging it overside—through a complete cycle in less than one minute's time. Of the cranes on board six are of three-ton capacity, two of one-ton capacity, and the remaining two are luffing cranes of 15-cwt. capacity. In addition to the cranes, there are four hydraulic ballards or small capstans, each driven by a three-cylinder hydraulic engine for working the boat falls.

Dundee Naval Submarine Base. — The Admiralty, it is believed, intend to make greater use of the submarine base on the Tay than hitherto. Colour is given to this belief by an application made to Dundee Harbour Trustees for several acres of ground at the east end of Dundee Docks. The intention of the Admiralty is to secure a long lease of the ground, and on it will be erected oil stores and other buildings. Up to the present time the accommodation at Dundee has been found in every way suitable for the submarines, and the base is within reach of suitable waters in which to practise submarine manœuvring. The practisings have been regularly carried on since the establishment of a base at Dundee, and unattended by accident, and the crews, which are changing from time to time, have greatly benefited by the training. On an average there are about twelve submarines stationed on the Tay, with the necessary complement of parent ships and torpedo boats, and it is understood that the new type of submarines will make their appearance on the river before long.

The Admiralty and Oil Fuel.—The Admiralty are about to provide oil fuel accommodation at Invergordon in the North of Scotland similar to the storage being provided at Dundee. The sum of £8,000 is allowed for this in the Navy Estimates, and it is believed that a small floating dock will also be provided at the Invergordon station.

THE TEES AND HARTLEPOOLS.

(From our Own Correspondent.)

Whitby.

At Whitby, shipowners are placing orders freely.

Messrs. C. Marwood & Co. have recently given out orders for the construction of two fair-sized cargo steamers.

Merrsrs. R. Harrowing & Co. have sold their s.s. *Ethelburg*, of 2,223 gross tons, to English owners for about £3,000.

Messrs. Milburn & Lund are reported to have placed a repeat order for a large-sized cargo steamer with Messrs. Irvine's Shipbuilding & Dry Dock Co., West Hartlepool, the engines and boilers being supplied by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool.

Middlesbrough.

Messrs. Sir Raylton Dixon & Co., Cleveland Dockyard, are reported to be likely to secure an order for two large cargo steamers for Liverpool owners, for which tenders have been submitted recently. They are fairly busy with recently-secured contracts.

Messrs. Smith's Dry Dock Co., South Bank, have a good amount of work on hand in all their departments, and are reported to have just secured orders for two small steamers.

Messrs. Richardsons, Westgarth & Co. are now fairly busy, having a great variety of work on hand both marine and land. All departments are now engaged

Messrs. W. Harkess & Co. keep fairly busy, but there is nothing new to report since last month. They, however, expect an order for a small steamer shortly.

Stockton and Thornaby.

Messrs. Richardson, Duck & Co. are now very busy, having recently secured contracts, which, with the work on hand, will keep them busy for some months to come.

Messrs. Craig, Taylor & Co. are also very busy with the recently-secured contracts, the yard presenting a more animated appearance than it has done for months.

Messrs. R. Ropner & Son still keep very quiet, though it is rumoured they expect an order for foreign account.

Messrs. Blair & Co. maintain a steady turn-over of work, and are reported to be very well booked, having orders for some months ahead.

West Hartlepool.

Messrs. Furness, Withy & Co. have recently sold the s.s. *Adand*, of 5,674 tons deadweight, to Greek owners, for about £16,500. They have now bought the s.s. *Indvadevi* (Messrs. Roydon & Co., managers) and re-christened her the s.s. *Chaseside*.

Messrs. W. Gray & Co. have recently booked an order from Messrs. J. Coverdale & Co.; a sister boat to the s.s. *Joseph Chamberlain*, for Messrs. Sanderson Bros. They are well supplied with work to keep them busy for months.

Messrs. Irvine's Shipbuilding & Dry Dock Co., Harbour Dockyard, have booked two small steamers, one for Belgian and one for Dutch owners. They keep very busy in all departments.

Messrs. R. Jobson & Son are reported to have bought the s.s. *Walter Scott*, 625 gross tons, of Messrs. W. Scott, Ltd., Hartlepool, and intend running her on their own account.

The Central Marine Engine Works of Messrs. W. Gray and Co. are very busy; besides having secured the contracts to supply the machinery for the steamers building by them, they are now placing on the market several of their specialities, and have several orders on hand for foreign account.

Hartlepool.

Messrs. Irvine's Shipbuilding & Dry Dock Co., Ltd., Middleton Yard, are now very busy; they are reported to have secured orders for two large steamers, which, with the work on hand, will keep them engaged for some time.

Messrs. Richardsons, Westgarth & Co. are very busy. They are believed to have secured the contracts to supply the engines and boilers for the steamers building at both yards of Messrs. Irvine's Shipbuilding & Dry Dock Co., and to have several large condensing plants on hand. They have three sets of turbine installations to start on, and their speciality department is in full swing. Sufficient work is in hand to keep them busy for some months to come.

THE HUMBER AND DISTRICT.

(From our own Correspondent.)

Messrs. Earle's Shipbuilding & Engineering Co., Ltd., have been very busy executing extensive repairs on the following steamers:—s.s. *Jaffa*, s.s. *Skogland* and s.s. *Selby Abbey*, all these vessels having been ashore on the Baltic and Dutch coasts. The cost of the repairs of each steamer will run into high figures. The s.s. *Jesseric* has also been in for extensive overhaul, having received a severe buffeting in the Pacific Oecan. Whilst the above steamers have been under repair they have been under Lloyd's and British Corporation Surveyors, and the work has been completed to the Societies' requirements. The new steamer *Hydro* is just completing and preparing for her trial trip. She will be used in the Baltic cargo trade of the Wilson Line, and is also adapted for the Manchester Canal. On the 16th March, the Company launched, with all machinery and fittings complete, a steel screw steamer, *Y.C. No.* 95, for the British Admiralty. The principal dimensions are:—Length, 110 ft.; beam, 24 ft.; depth, 12 ft. This vessel is the first of the type built for the Admiralty, and has been constructed to the builders' own design and specification under Admiralty Survey, for transporting ashes from battleships in docks or rivers and discharging refuse at sea. The shipyard engine and boiler shops are working at full pressure.

Messrs. Stewart & Craig, engineers and boilermakers, have had an excellent month and carried out some extensive repairs in machinery and hulls of steamers in graving dock. The firm appears to have established themselves with the shipowners frequenting the port.

The North-East Coast Engineering Works, Ltd., have had some very extensive repair work during the last month with the following vessels:—s.s. *Exmoor*, s.s. *Myrtoon*, s.s. *Fox*, s.s. *Sea-Gull*, s.s. *Scottish Monarch*, s.s. *Riverton*, s.s. *Garton*, and s.s. *Nauta*. The s.s. *Alicia* has also been in the graving dock undergoing very extensive repairs, including damage to stern, etc. Several enquiries have been received from different hipowners, whose steamers are bound for this port.

Messrs. Cooper & Co., Ltd., Neptune Engine Works, are very busy with repair and graving dock work. The engine works have been working at full pressure. A large number of workmen are employed to compete with the work on hand. The branch shop at Alexandra Dock is busily engaged with repairs, etc., on steamers in Victoria and Alexandra Docks, and the Company's two graving docks, situated on the river Hull, have been fully employed with coasting and small craft.

Messrs. Amos & Smith, engineers and boilermakers, Albert Dock Works, are still booking orders for boilers and machinery for trawlers and large steamship owners, with delivery late in the year. Their outside staff is well employed on local and outside firms, on repair and survey work. The branch shop (Alexandra Dock) is also in full swing, with graving dock repairs, etc., and the Albert Dock works are working at full pressure night and day.

Messrs. Woodall & Co., engineers and boilermakers, have had a fairly good month in and around the Docks, in general repair work, especially in the coasting and foreign steamers. The blacksmith's shop is fully employed with heavy forgings for several English Railway Companies. In addition, they receive a great deal of work from the Hull Corporation (Trams Department). The patent "Handibloc" made by this firm is in great demand at home and abroad.

Messrs. Cochrane & Sons, shipbuilders, Beverley, are fully employed, and have in hand a large number of trawlers to build for Grimsby and Hull owners, which will keep this yard practically engaged during the whole of this year.

Messrs. Cook, Welton & Gemmell, Ltd., shipbuilders, Beverley, are busily engaged in the building of trawlers for Grimsby and Hull owners. They have recently launched the s.t. *Imperialist* and s.t. *Escallion* for Grimsby owners, each about 140 ft. by 24 ft. by 13 ft. 4 in. Both vessels are fitted with the latest improvements to pass Lloyd's Survey, and are intended for the Icelandic and White Sea fishing. They have also under construction five other vessels.

Messrs. C. D. Holmes & Co., Ltd., engineering works. This old-established house are very busy building boilers and machinery for trawlers and several drifters' engines, and have received a great many orders for their patent large compound winches, centrifugal pumps and donkey engines. The moulding and pattern shops and the branch shop at Alexandra Dock are keeping fairly busy with general repair work on the steamers coming to the various docks. Several enquiries have come in from outside shipowners whose steamers are coming to the port.

STEAM PIPING ARRANGEMENTS.—With reference to the letter on this subject in our correspondence columns, the patents held by Mr. Yates are as follows:—No. 10557 of 1909, Combined steam and exhaust pipe and No. 10558 of 1909, Method of preventing condensation in steam whistle pipes.

THE UNITED STATES METALLIC PACKING CO., LTD., in order to cope more promptly and satisfactorily with their business in Northumberland, Durham and North Yorkshire, have opened a branch office at 2, Collingwood Street, Newcastle-on-Tyne, which will be in the charge of Mr. H. B. Plummer.

SOUTH OF ENGLAND AND ISLE OF WIGHT.

(From our Own Correspondent.)

The Royal Mail Steam Packet Co.—The Directors have decided that the new "A" class vessel now building by Messrs. Harland & Wolff shall be named the *Arlanza*. The vessel will be an improved *Asturias*, and will be the sixth vessel of this class the builders have supplied within the last six years. She is expected to take her place on the Company's Brazil and River Plate service early next year. The *Arlanza* will be driven by four crank triple-expansion engines on the wing shafts, with a large exhaust turbine on the centre shaft.

Dredging at Southampton.— The Harbour Boards' Bill before the Parliamentary Committee has now advanced to a stage which is causing a great deal of discussion in local shipping circles. The chief clause, *i.e.*, that relating to differential dues, has been struck out of the Bill, but the Board have been granted borrowing powers to the extent of £200,000, which has to be expended solely on dredging and maintaining the channel. No further powers are to be granted until the question of the constitution of the Board has been discussed. The matter now before the Corporation is that relating to the payment of one-fifth of the dues to the town, and whether this will be continued after the reconstruction of the Board.

Messrs. J. I. Thornycroft & Co., Ltd., Southampton.—H.M. ships *Larne*, *Lyra*, *Martin* and *Minstrel*.—The first two vessels are now in commission, and H.M.S. *Martin* followed about the end of last month. H.M.S. *Minstrel* carried out satisfactory preliminary trials last month and will shortly be handed over also. H.M. ships *Acheron* and *Ariel*. The boiler-rooms of the *Acheron* were water-tested last month, and the shell of the *Ariel* was completely plated and riveted. The barge for Portsmouth Dockyard was completed and handed over about the middle of last month. Fire-float *Gamma*.—This vessel was delivered early in March, and made the passage from this port to the Thames under her own power. Stern-wheel passenger steamer for the Persian Gulf.—The hull of this vessel has been progressing rapidly and is now riveted, and the awning deck has been erected. Armoured motor patrol boats.—The machinery was fitted to the first of these boats last month, and good progress is being made on the remaining boats. An order for eight additional boats to the same specification, making eighteen in all, was received about the middle of March from the Turkish Government. The oil-fuel carrying barge for the Borneo Company is nearing completion and will be delivered this month. A number of steam yachts have been under repairs during the month, and the firm were notified that their tenders for the repairs to H.M. ships *Halcyon* and *Argus* had been accepted, and work was commenced about the end of the month on these vessels.

Messrs. J. Samuel White & Co., Ltd., East Cowes, I. of W.—H.M.S. *Rifleman*, 27-knot torpedo-boat destroyer, and the second of the three destroyers built by the firm, has been completed and handed over to the Admiralty. H.M.S. *Ruby*, a sister ship, completed her sea trials and inspection, and will shortly be handed over also. Work is proceeding on H.M. ships *Feret* and *Forester*, and on the barges for the Imperial Russian yacht *Polar Star*.

Messrs. Day, Summers & Co., Northam Iron Works, Southampton.—Good progress has been made with the new paddle-steamer for The South of England and Isle of Wight Steam Packet Co., and she will be launched early this month. The work on the engines and boiler is also in an advanced state. Last month the firm booked an order to fit a new boiler to the s.y. *Capercailze*, and the work is now well in hand. The s.y.s *Madrigal* and *Assagai* had their boilers surveyed, and new masts were fitted to the s.y. *Dotterel*. The s.y. *Lady Evelyn* arrived at the yard last month, and will have her steam engines refitted after the successful trials which have been given to the motors, which were installed last summer. Last month a number of vessels were on the slip for painting, etc.

Messrs. Simpson, Strickland & Co., Ltd., Dartmouth, S. Devon, are very busy in all departments. A 30-ft. steam pinnace, and three 35-ft. steam cutters, to the order of the British Admiralty, were despatched last month, and work is proceeding on a very fine high-class 30-ft. steam cutter for H.M.Y. *Alexandria*. Work in hand comprises five high-class boats for a yacht building in the north, a 22-ft. yacht's steam launch, and a 30-ft. steam launch for the Union Steamship Co. of New Zealand for one of their Mail ships. A 25-ft. steam launch for the new yacht for H.M. Prince of Monaco, and two exceptionally fine steam launches for the large steam yacht now building at Clydebank. In addition to the machinery for steam boats building, a large quantity of machinery for other firms is in hand, including a set for Brazil, and the machinery for four twin-screw steamers. The latter order consists of compound engines and water-tube boilers. A large amount of repair work is also in hand including new cabins to s.y. *Kathleen*, alterations to cabin work on the auxiliary ketch yacht *Brown Mouse*, alterations to the rig of the yacht *Florinda*, and the barge-yacht *Thoma II.*, which is having one of the firm's motors fitted. In addition to the above several boilers are on order.

Cunard Line.—The taking over by the Cunard Co. of the fleet of the Cairn Line of Steamships, Ltd., is dealt with under "Fleets of the Mail Lines."

THAMES.

(From our Own Correspondent.)

Shipping and Docks.— The Regents Canal and Dock Co. has declared a dividend of 2 per cent. per annum on the capital for the past half-year with £689 forward. The year's nett revenue was £25,390. With Messrs. W. France, Fenwick and Co. the dividend for 1910 on the ordinary shares was 6 per cent. and a bonus of 2 per cent., the profit, including £6,729, brought in was £56,888. This Company owns nineteen steamers, seven of which have been ordered since 1906 and two more are building.

Thames Shipbuilding.— Mr. A. F. Hills, of the Thames Ironworks, is making strenuous endeavours to keep the river to the front for future orders and trying in a laudable manner to secure the support of Unionist London members and public bodies such as the City Corporation, London County Council and the Chamber of Commerce, to stand by him in the hope of keeping the trade on the river. It is urged that the staff the company has got together to build the *Thunderer* should not be dispersed and the need therefore for further work.

Sir W. H. White.— An honour has been accorded this well-known naval architect in the award to him of the John Fritz medal for 1911. The medal is given by the four American societies, the Civil, Mining, Mechanical and Electrical Engineers, to anyone distinguished in science and is recognised as the highest distinction which American engineers can bestow. Lord Kelvin, Alex. Graham Bell, Thos. A. Edison, Geo. Westinghouse and Alfred Noble have been previous recipients.

A New Fire Float.—The London Fire Brigade has received a new fire float named *Gamma* from the builders, Messrs. Thornycroft and Co., of Southampton, which came round to the Thames on her own power. The vessel is motor-propelled instead of, as hitherto the case in the *Alpha* and *Beta* driven by steam. In this case the engine is an oil one giving a speed of 10¾ knots on four hours' continuous running. A display of her power has taken place before the chairman of the Committee of the Fire Brigade of the London County Council. Eight jets were used at one time, then one delivery of exceptional force was used. The estimated cost is £4,500 against £11,000 for the *Beta* and £6,000 for the *Alpha* steam floats, so a saving has been made by the change.

Yacht Racing.—The Yacht Racing Association has held its annual meeting in London, at which there was a large attendance of members. It was announced that King George had given his patronage to the association and particulars were furnished of the forthcoming European festival of yacht racing to be held in the Solent in August next. Sir Geo. Leach, K.C.B., was elected president, and a resolution was passed that yachts of the international classes shall have an index letter and number as a compulsory measure.

National Physical Laboratory. — At the invitation of the President of the Royal Society many scientific men went to Teddington recently to make an inspection of this laboratory. The plans, models and developments of scientific discoveries were examined with much interest. The President, Sir A. Geikie, is chairman of the general board of the laboratory, and Lord Rayleigh chairman of the executive committee. Among those present were Rear-Admirals Bacon and Field, Sir David Gill, Sir W. H. White, Professors Unwin and Dalby, Sir John I. Thornycroft and Admiral Sir A. K. Wilson.

A River Fire.—An unusual event has taken place on the river, a ship, the *North Point*, of 5,216 tons, belonging to the Furness line having been completely enveloped in flames. The crew, numbering forty, escaped over the side of the vessel, being off Purfleet and proceeding down Long Reach at the time. The iron plates of the vessel are said to have been red-hot to the water's edge. It was soon impossible to go from one part to another of the vessel. Floating fire engines were employed, but the cargo being partly creosote was probaby the cause of the disaster.

MERSEY AND MANCHESTER SHIP CANAL.

(*From our Own Correspondent.*)

WORK in this district continues to be very brisk, and it is probable that this state of things will be maintained. It is very gratifying that such a fair measure of Admiralty work is being carried out in the Mersey Port. With the splendid facilities now available it is to be hoped that the lead given by some of the local shipowners will be followed, and that more of our large passenger liners may be constructed in this district, so devoted to marine matters.

Messrs. Cammell, Laird & Co.—It is gratifying to note that of the 8½ millions sterling to be paid out during this year by the Admiralty for construction in private yards, Messrs. Cammell, Laird & Co. will receive £1,143,055; this amount is only exceeded by that to be received by Messrs. Vickers, Sons & Maxim, which firm will receive £1,348,675, Scott's, of Greenock, coming third on the list, with £1,099,292. H.M.S. *Blonde*, whose machinery has been built by Messrs. Cammell, Laird & Co., has recently completed her trials very successfully. The cruiser *Melbourne* is making rapid progress, also the floating dock and the "Super-Dreadnought" which, together with other work for the British Admiralty, is keeping the staff working at extra pressure. The destroyers *Lapwing* and *Lizard*, also the two tenders to the submarine depot ship, are making rapid progress, and the delay due to the late labour trouble is fast being overtaken. The *Santa Fe*, the second of the fast destroyers for the Argentine Navy, was launched on the 15th of March, and is the second of the four vessels now building at Birkenhead. The *San Luis* is now completing, while the remaining vessels are nearing the launching stage. The association of this South American Government with Messrs. Cammell, Laird & Co. extends over forty years, during which time some eighteen vessels have been built, including the training-ship *President Sarmiento*. The Nelson Liner *Highland Loch* ran a very successful trial on the 11th March. The *Highland Piper*, the fourth vessel for the Nelson Line, was launched on March 18th. The Amazon steamer *Montenegro* has now left for Para under her own steam, being specially prepared for the journey. The *Queen Amelie* is still in dry dock, the extensive repairs not being yet completed. The Great Western steamer *St. George* has now left after extensive overhaul.

Messrs. H. & C. Grayson have, as usual, a full number of extensive and varied contracts on hand at their various yards. The steamer *Drumcliffe* has been in the Langton Dock for heavy bottom repairs, while at the north end a Russian steamer has had extensive alterations for the transport of chilled meat and fish from the East. The large screw tug and tender for the P.S.N. Co. has been completed at the Garston Works. The White Star Liner *Germanic* has had extensive alterations, having been sold to the Turkish Government. The oil steamer *Potomac* has completed heavy repairs at the Birkenhead Yard.

Messrs. Clover, Clayton & Co.—Work at this yard, which is now in close alliance with Messrs. Grayson's, has been generally brisk. The steamers *Hycrania*, *Abergeldie*, *Glenhead* and *Gem*, also the wooden barque *Claudia*, have been in for general repairs. This firm have recently brought their graving docks more up-to-date by the deepening of two of them, while larger pumping plant has been installed.

The White Star Line.—With the *Olympic* having dry-docked at Belfast preparatory to her maiden voyage from Southampton on June 14th, together with the fact that the *Titanic* is to be launched on the 31st of May, the fleet of this Company will soon be largely augmented. In this connection it is of historic interest to note that the *Germanic*, which has a tonnage of 5,071, and was built by Messrs. Harland & Wolff in 1874, left the Mersey for probably the last time on March 15th. She has been sold to the Ottoman Government through the agency of Messrs. H. E. Moss & Co., and has been fitted up as a troopship. After extensive alterations and overhaul she has maintained a speed of 18 knots, her best while on the American service being 16·10 knots. Permission has now been granted by the U.S. War Department for the extension of the New York Piers, and a Joint Commission has been appointed to enquire into the docks on the Hudson River, the States of New Jersey and New York, also the War Department being represented.

The Canadian Pacific Railway Co.—It is understood that the orders for the new steamers contemplated by this progressive Company will shortly be placed. These vessels will, it is expected, be 675 ft. long with 80 ft. beam, and will be driven at 23 knots by turbines. The fittings, speed and type will prove that the aim of the Company is to revolutionize the Canadian-Atlantic trade, and to make this the most expeditious route to North America. Other vessels of this fleet, *viz.* :—The *Empress of Britain*, *Empress of Ireland*, *Lake Champlain*, *Lake Manitoba* and the *Montrose*, are being improved, and are having their open steerage accommodation converted into closed cabins. Messrs. Hoskins & Sons, Ltd., of Birmingham, are supplying all the compartments on the portable shutter system, also all the berths and lavatories, and while the contract was only commenced at the end of January it was completed by March 11th.

Cunard Line.—The purchase of the fleet of the Cairn Line of Steamships, Ltd., is dealt with under "Fleets of the Mail Lines."

The Manchester Ship Canal.—Estimates have been prepared of the amount to be expended in connection with the Bill now before Parliament. The total is put down at £99,046 16s. The works contemplated being a pier or jetty at the Eastham entrance, a short junction line of railway, joining the Company's line between Latchford Locks and Eccles Wharf, with that between Barton Yard and Manchester Docks. The capital will be provided out of moneys in hand or which they have power to raise.

The Isle of Man Steam Packet Co.—It is reported that this Company have taken over the undertaking of the Manx Steam Trawling Co., who run one steamer, the *Tyrconnel*, which trades between Manx ports and the main land. The capital is £4,000, and the purchase money represents 25/- per share.

NORTH-WEST OF ENGLAND.

(*From our Own Correspondent.*)

Barrow-in-Furness.—All is activity and rush at the naval construction works of Messrs. Vickers, Sons & Maxim, at Barrow. This is more particularly the case in reference to the battleship-cruiser *Princess Royal*, which is to be launched on the 29th of April. The delay which occurred in her construction by reason of the lock-out of the boilermakers is being rapidly made good by the overtime which is being put in, and by the exercise of care that no interruption is permitted to occur by reason of waiting for material or the necessity of dove-tailing of departmental work into the whole fabric. Now the days are lengthening it is possible to work longer hours on the vessel, without the aid of electric light, which is frequently being used to get on with the work, so as to avoid any possible waste of time. Already the huge cradle which is to carry the great vessel into the water is approaching finality in construction. The launching ways at Barrow are very firm and capable of carrying an immense weight, and the particular ways on which the *Princess*

Royal is being built have already carried very many heavy ships, such as the battleship *Dominion* and the cruiser *Powerful*. There have been but a small percentage of failures in launches at Barrow, because the management take every precaution to err on the right side, and thus secure a very large margin of safety. Much work, even from a shipbuilding point of view, will have to be done after the great ship is launched, and, of course, immediately she is berthed under the 150-ton crane in the Buccleuch Dock, there will be quite an army of workmen, including engineers, boilermakers, those who are employed in gun-mounting, plumbers, painters, electricians, and others who have each much to do in making the ship a complete and finished unit. The vessel is the largest ship ever built at Barrow, but a much larger vessel is in course of initial construction for the Japanese Navy. She is also a battleship-cruiser, and the work on her is also being pushed forward with as much celerity as possible. Before the *Princess Royal* is fully equipped for service, the Japanese vessel will be launched. Thus the activity at the fitting-up berth in the Buccleuch Dock may be expected to be maintained for a couple of years to come, and particularly so, as it is practically a certainty that other orders for the home and for foreign Governments will be placed in the meantime. There are more men employed at the Vickers' works at Barrow at present than were ever known in the history of the Company, and the probability is that ere long a largely-increased number of men will find work in this huge establishment.

A Floating Crane.—The Vickers Company have bought the old Walney steam ferry, which, until Walney Bridge was built, was used to carry the thousands of men employed by the firm to and from Vickerstown. This ferry is being strengthened and water tanks are being provided, with a view of balancing the boat when she is carrying heavy weights on the jib of her crane. This vessel, when complete, will be able to carry big weights from the fitting-up wharf in the Devonshire Dock to the fitting-up wharf in the Buccleuch Dock, and by means of her crane she will be able to lift up guns, armour, boilers, engine-room fittings and so on required to complete any ship in course of construction. The floating crane will be an immense acquisition to the resources of the firm.

Turkish Battleship.—The Turkish Commission, which is travelling in this country with the view of fixing up the orders for two "Dreadnoughts," visited the Barrow yard on the 16th and 17th March, and made a complete inspection of the Barrow works. They were highly gratified with what they saw, and with the up-to-date appliances in the hands of the Vickers Company for turning out ships, engines, gun-mountings and all other factors which go to the production of a great ship of war. It has been officially notified that the order for these two ships will go to the Armstrong group, and it may be that Armstrong's and Vickers' will each get one of the ships to build, or that Armstrong's will build both ships and the Vickers' firm get the orders for the engines, boilers, etc., while sharing with Armstrong's in the guns and gun-mountings. Soon it is expected the Commission will report on the final determination as to the armour and guns, and then it will be known how the orders will be allocated.

The Naval Airship.—The naval airship built by the Vickers' firm for the Admiralty is now completed and ready for her inaugural spin in the air. She has, in fact, been waiting for good weather and favourable atmospherical conditions. She will, it is expected, sail away from the place of her birth early some morning, and if she has a successful trial she may not return to Barrow, but find a home in some other garage. In the meantime it is understood that work has been proceeding quietly in the preliminaries of the construction of airship No. 2. It seems, indeed, probable that airship construction will become a permanent and important local industry here, as with the experience gained already and with the advice of Admiralty experts, much technical knowledge has already been acquired, and this will be added to when airship No. 1 begins to get her trials in the air. Her officers are all at Barrow ready to man the interesting craft.

A Montreal Floating Dock.—The Vickers' firm are reported to have secured the order for a floating dock for the Canadian Government to be built at Barrow and have her home at Montreal.

Vickers', Limited.—Intimation is given in the annual report of Messrs. Vickers, Sons & Maxim that it is proposed to alter the name of the firm to Messrs. Vickers, Limited.

Other Work.—The construction of the Chinese cruiser and of a British torpedo-boat destroyer is proceeding apace. Two portions of the Aberdeen floating dock have already been launched, and the rest of the vessel will take the water soon. Then the segments will be joined together and she will proceed to her northern home. The Vickers' firm are now employed on four submarines of the "E" class, and are completing their contracts on several of the "D" class.

Engineering.—There is very great activity in every branch of the engineering trades, and double shifts are being worked in most departments.

Shipping and Hæmatites.—Shipping is weaker in iron and steel exports. Hæmatites are depressed at about 66/6 makers' iron and 65/- warrant sellers. Stocks are not materially increasing.

BELFAST.

(*From our Own Correspondent.*)

Wages.—In last month's Notes reference was made to the increase in the rates of wages to be paid to the carpenters, and to prospective requests for advances in other branches of the shipbuilding and engineering trades. Since those notes were penned the A.S.E., the Steam Engine Makers' Society, The United Patternmakers' Association, The Brassfounders' Association and The United Machine Workers' Association have, through the medium of a joint committee, made application for an advance of 2/- per week on the current rates of wages on and from the first day in April. It was thought that 2/- was asked for with a view of making certain a rise of 1/-, but it now appears that the men are holding out for the full increase asked for, and at time of writing a settlement has not been come to. The Black Squad are also applying for a rise, so that as predicted in last month's issue, there will have to be certain concessions made all round. It was at one time an understood thing that wages on the Clyde were to rule those in Belfast, but wages in the Belfast yards are at present, and have for some time past, been higher generally than in Glasgow. There is no reason why this should be, in fact the position should be reversed, for it is a well-known fact that living is cheaper in Belfast than in Glasgow, or any other large shipbuilding centre.

Messrs. Harland & Wolff.—By the time this issue is in the hands of readers, Belfast's new graving dock will have been opened, and the ceremony will be doubly interesting in view of the fact that the *Olympic*, the largest vessel afloat will be the first to be docked in it. On February 8th, the launch of a noteworthy vessel took place from the south end of the Queen's Island, when the triple-screw Aberdeen liner *Demosthenes* was sent from the ways. The latest addition to this well-known fleet is a vessel of about 11,300 gross tonnage, with a length of 517 feet, and 62 feet 3 inches beam. In addition to handsome and commodious passenger accommodation, the *Demosthenes* has extensive cargo-carrying capacity, there being seven hatches served by seventeen winches, and powerful electric lights will be provided, so that loading or discharging can be carried on at night as well as by day. The wing propellers will be driven by triple-expansion engines, and the centre by a low-pressure turbine. Messrs. Elder, Dempster & Co. have placed an order for two steamers for their West African service, and it is understood that the vessels will be built at the Queen's Island. Messrs. Harland & Wolff are also credited with having received an order from the Hamburg-America Company for two vessels. Within the next few weeks they will launch a new Union-Castle liner, and two tenders for the White Star Line.

Messrs. Workman, Clark & Co.—This firm recently had a successful trial of the new fruit steamer *Aracataca*, which was built by them for Messrs. Elders & Fyffes, Ltd. She is 390 feet long, with a gross tonnage of about 4,150 and is intended for the Company's West Indian fruit trade. Her engines are triple-expansion, steam being supplied by

four single-ended boilers working under forced draught. The extensive engine repairs and renewals on the Italian liner *Verona* have been completed, and the vessel has left the port, and the Anglo-American Oil Company's sea-going barge *Navahoe* is in dock, receiving her new stern-frame. A few weeks ago the first keel was laid down in Messrs. Workman, Clark & Co.'s extension on the north side of the river. On 15th March, they launched the twin-screw steamer *Egra*, which they have constructed to the order of the British India Steam Navigation Company, Ltd. She is 424 feet long, and has a gross tonnage of 5,000. There is commodious and comfortable accommodation for fifty first-class and forty second-class passengers. The propelling machinery consists of two sets of triple-expansion engines, steam being supplied by four large boilers working under forced draught.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Vosges.—On February 14th, Messrs. Sir Raylton Dixon and Co., Ltd., launched from their Cleveland Dockyard, Middlesbrough, a fine steel-screw passenger and cargo steamer which is being constructed to the order of Messrs. James Moss & Co., of Liverpool. Her principal dimensions are 256 ft. 3 in. by 38 ft. by 18 ft. moulded, and she will have a deadweight carrying capacity of nearly 2,000 tons on a light draught of water. She is being built to the highest class at British Corporation and is of the single-deck type with shelter-deck and bridge and forecastle. Captain's accommodation, chart-room and entrance-house to saloon will be provided in a neat steel house on bridge deck, and on the deck below will be the saloon and the first-class state-rooms at fore end, and officers' and engineers' berths at the after end. The petty officers will be located in forecastle, while the firemen and crew will be quartered in poop. The vessel has two holds, four hatches, two masts, nine derricks, and will be equipped with five steam winches, steam windlass, hand and steam-steering gear, electric light and all the most modern appliances for the rapid handling of cargo. Triple-expansion engines having cylinders 21½ in., 36 in. and 59 in. by 39 in. stroke, supplied with steam by two large single-ended boilers working at 80 lbs. pressure, will be fitted by Messrs. John Dickinson and Sons, Sunderland.

Grainton.—On February 14th, Messrs. Ropner & Sons, Ltd., Stockton-on-Tees, launched from their shipbuilding yard a steel screw steamer of the following dimensions, *viz.* :—Length, 429 ft. ; breadth, 55 ft. ; depth, 34 ft. 7¼ in. The vessel will be classed 100 A1 at Lloyd's, having main deck, and complete awning deck fore and aft. Accommodation for captain in deckhouse amidships ; officers and engineers in after 'tween decks ; crew forward. The vessel has double bottom for water-ballast on the cellular principle, all fore and aft, and in fore and after peaks. She will be fully equipped with an up-to-date outfit, including quick warping steam windlass, stockless anchors, steam-steering gear amidships and powerful screw gear aft. The appliances for loading and discharging cargoes expeditiously are very complete, and include five steam winches, double derricks to each hatch, steam being supplied by a large auxiliary boiler working at 180 lbs. pressure per square inch. The engines will be of the triple-expansion type by Messrs. Blair and Co., Ltd., Stockton-on-Tees, of about 2,000 I.H.P., having two steel boilers 16 ft. 6 in. by 11 ft. 6 in., 180 lbs. steam pressure. Messrs. Wailes, Dove & Co.'s " Bitumastic " enamel was applied to bunkers and engine and boiler-room tanks and their " Bitumastic " covering to tank top in engine and boiler space.

Castro.—On February 15th, a handsomely-modelled steamer, the *Castro*, built to the order of Messrs. Thos. Wilson, Sons & Co., Ltd., for the general Baltic trade, was launched from the yard of Messrs. Earle's Shipbuilding and Engineering Co., Ltd., Hull. The principal dimensions of the *Castro* are :—Length, 250 ft. ; breadth, 35 ft. ; depth, 18 ft. moulded. She has been constructed of steel to the British Corporation Registry's highest class and to the Board of Trade latest requirements. The vessel is of single-deck type, with short poop, long bridge, and topgallant forecastle, and will be fitted with two pole masts to suit Manchester Ship Canal regulations, and is capable of carrying a large quantity of water-ballast. A commodious deck-house has been provided on the bridge deck amidships for the accommodation of captain, officers, engineers and steward. The vessel will be fitted with all necessary derricks and cargo gear, four steam winches, steam windlass and steam and hand-steering gear.

9,000-ton Steamer.—On February 15th, there was launched from the yard of Messrs. The Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne, a fine shelter-deck vessel built to Lloyd's 100 A1 class. She is built on the deep frame and girder system, rigged as a two-masted schooner, and is fitted with all the latest improvements and up-to-date appliances to make her in every way a first-class liner. She is about 425 ft. in length, with three complete steel decks, including the shelter deck all fore and aft, with a cargo-carrying capacity of about 9,000 tons. A large quantity of water-ballast is carried in the cellular double bottom, after-peak tank, and large deep tank, which, with the bunkers, will put the vessel in excellent trim irrespective of cargo. The shelter 'tween deck is of exceptional height, and is arranged so that a large number of emigrants can be carried. The saloon accommodation is placed on top of shelter deck. Loading and discharging facilities are considerably in excess of usual. The steamer has ten derricks and ten powerful steam winches with extended shafts, by Messrs. Clarke, Chapman & Co., Ltd., Gateshead, to ensure the most expeditious handling of cargo. The vessel has been built to a fine model and to include the most modern improvements, including Board of Trade regulations.

Kilda.—On February 16th, Messrs. The Goole Shipbuilding and Repairing Co., Ltd., launched from their Victoria Shipyard, Goole, a handsomely-modelled steel screw trawler of the following dimensions :—Length overall, 126 ft. 8 in. by 23 ft. by 12 ft. 6 in. The vessel has been built considerably above Lloyd's highest class, and under special survey, and is equipped generally with all the latest improvements for trawling off Iceland, and in the Bay of Biscay, etc. The holds have been specially insulated with cork, and a large tank has been fitted under the bunkers for feeding the boiler. Engines of good power will be fitted by Messrs. Earles' Shipbuilding & Engineering Co., Ltd., of Hull. The vessel has been built to the order of Messrs. J. Marr & Son, Ltd., of Fleetwood, and the construction has been personally supervised by Mr. J. H. Marr, managing director of the firm, and by Mr. J. A. Robertson, both of Fleetwood. This is the eighth vessel Messrs. The Goole Shipbuilding & Repairing Co., Ltd., have built for this firm.

Linesman.—There has been launched from the building yard of Messrs. J. P. Rennoldson & Sons, South Shields, a finely-modelled steel screw tug, dimensions :—Length, 85 ft. ; breadth, 18 ft. ; depth moulded, 10 ft. 9 in., built to Lloyd's A Class for towing purposes. The equipment is of the latest type and includes steam windlass, steam-steering gear, etc. The propelling machinery, supplied by the builders, consists of one set of compound-surface-condensing engines, having cylinders 15½ in. and 32 in. diameter by 21 in. stroke. In these are combined all the latest improvements, including team reversing gear. Steam is supplied by one multitubular-boiler having a working pressure of 130 lbs. on the square inch. The *Linesman*, which is a sister tug to the *Merman*, recently launched from the same yard, has been built to the order of Messrs. T. Gray & Co., Ltd., of Hull, and is intended for towing service on the Humber and East Coast. This is the twelfth tug built by Messrs. Rennoldson for the same owners. Messrs. Wailes, Dove & Co.'s " Bitumastic " enamel was applied to internal surfaces.

Yesso.—On February 16th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 119 ft. by 22 ft. by 12 ft. 3 in. moulded. The vessel has been built to the order of Mr. H. L. Taylor, of Grimsby, and will be fitted with powerful triple-expansion engines by Messrs. Amos & Smith, Ltd., of Hull, and is replete with all the latest improvements for fishing purposes.

American Transport.—On February 16th, Messrs. Irvine's Shipbuilding & Dry Docks Co., Ltd., launched from their

Middleton Shipyard, West Hartlepool, the steel screw steamer *American Transport*, built to the order of Messrs. Furness, Withy & Co., Ltd., West Hartlepool, for Messrs. The Empire Transport Co., Ltd. (Messrs. Houlder Brothers & Co., Ltd., managers), London. The dimensions of the vessel are 400 ft. in length by 52 ft. beam extreme, by 29 ft. 6 in. depth moulded, carrying over 8,200 tons on a moderate draught. She is built to British Corporation classification, having a single deck of steel with clear holds, with poop, bridge and forecastle, and water ballast is carried in cellular double-bottom and in fore and after-peak tanks. The vessel is constructed with deep frames and longitudinal stringers, and is divided into seven water-tight compartments by means of six water-tight bulkheads. Wood grain divisions are fitted throughout the holds according to the latest Board of Trade regulations. Four large hatches are provided and a cross bunker hatch, and all the latest facilities are provided for the rapid loading and discharging of cargo, including eleven steam winches exhausting back into stokehole, and twelve derricks. A powerful quick-warping steam windlass is fitted forward, with steam-steering gear amidships and hand gear aft. The captain, officers and engineers will be berthed in large houses amidships, and the crew and firemen in the forecastle. The lighting, heating and sanitary arrangements have received special attention, the most improved methods being adopted throughout. Triple-expansion engines are being supplied by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, with cylinders 25 in., 40 in., 68 in. by 48 in. stroke, with three large boilers working at a pressure of 180 lbs. per square inch.

Denis.—There has been launched on the Tyne by Messrs. R. & W. Hawthorn, Leslie & Co., Ltd., a steamer, named *Denis*, the second of three they are at present constructing to the order of the Booth Steamship Company, of Liverpool. The *Denis* is intended for the South American passenger and cargo trade between Liverpool and the Amazon, and will carry a deadweight cargo of over 6,100 tons. The dimensions are 355 feet by 50 feet by 26 feet, and she is being built under Lloyd's special survey to take their highest class. Splendid accommodation for forty-six first-class passengers is placed amidships. The dining saloon, panelled in mahogany, and the smoke-room, panelled in oak, are also amidships, whilst the verandah café is arranged aft. Comfortable accommodation for 100 steerage passengers is arranged in the shelter 'tween deck aft. An installation of wireless telegraphy will be fitted. Steam is supplied by two powerful boilers working at a pressure of 180 lbs. under forced draught. The *Denis* will sail from Liverpool about April 27th on her maiden voyage, proceeding to Para and Manaos *via* Penarth, London, Leixoes, and Lisbon.

Zeitieh.—On February 15th, Mr. William Walker, of Maryport, launched a steel screw steamer to the order of The Egyptian Oil Trust, Ltd., London. She was christened the *Zeitieh* by Miss Nancy Walker. The dimensions are :—Length between perpendiculars, 121 ft. ; breadth moulded, 22 ft. ; depth moulded, 10 ft. 6 in. She will be fitted with C.S.C. engines by Mr. James Ritchie, Glenavon Engine Works, Partick, Glasgow, having cylinders 15 in. and 32 in. by 22 in. stroke. Boiler 11 ft. by 10 ft. by 130 lbs. w.p. The vessel is also fitted with an oil fuel installation by The Wallsend Slipway & Engineering Co., Ltd., Wallsend-on-Tyne. She has accommodation for six passengers. The vessel is built to the highest class at Lloyd's, and is intended for the Red Sea trade.

Rudmore.—On February 28th, there was launched from the shipbuilding and repairing establishment of Messrs. S. P. Austin & Son, Ltd., the steel screw steamer *Rudmore*, of 1,320 tons deadweight capacity, which has been built to the order of James Westoll, Esq., of Sunderland. She will be classed 100 A1 in Lloyd's Register, under special survey ; large water ballast capacity is provided and there are large hatchways specially adapted for the coal trade. Accommodation for captain and officers is fitted in the bridge, engineers aft, and for crew in the forecastle. The machinery, which is to be placed aft, will be supplied by Messrs. George Clark, Ltd., Sunderland. The auxiliary machinery is also by first-class makers. A Cochran (Annan) donkey boiler with patent seamless furnace has been supplied and fitted.

Budapest.—On February 28th, Messrs. Richardson, Duck and Co., launched from their shipyard the first of two steel screw steamers which have been ordered on behalf of the "Atlantica" Sea Navigation Co., Ltd., of Budapest, by the Director-General, Mr. Eugen Pollacsek. The vessel is of the following dimensions :—Length overall, 345 ft. ; Length B.P., 331 ft. ; breadth extreme, 48 ft. 3 in. ; depth moulded, 24 ft. 6 in. She is capable of carrying about 5,300 tons deadweight on a draught of water of under 21 ft. The vessel is of the single-deck type with poop, long bridge, and forecastle. The captain's rooms are on the lower navigating bridge, and saloon, officers' and engineers' accommodation in houses on bridge deck. The seamen, firemen and petty officers are berthed in the topgallant forecastle. The vessel is constructed to Lloyd's rules for their highest class and under special survey. An ample supply of water ballast is carried in double bottom. Steam windlass, steam-steering gear, a large number of steam winches, steam heating, and electric lighting are provided. Triple-expansion machinery will be fitted by Messrs. Blair & Co., Ltd. The cylinders will be 24 in., 40 in. and 65 in. by 42 in. stroke, and there will be two single-ended boilers 15 ft. 6 in. diameter by 10 ft. 6 in. long, working at 180 lbs. pressure.

Atlantica.—On February 28th, Messrs. Wood, Skinner and Co., Ltd., launched from their shipyard at Bill Quay, Newcastle-on-Tyne, a fine large steel screw steamer which they have built to the order of The "Atlantica" Sea Navigation Co., Ltd., of Budapest. The vessel is of the single-deck type with poop, bridge and topgallant forecastle, having accommodation in a large steel deckhouse amidships for captain, spare berths, etc., the officers' and engineers' berths being in sidehouses on bridge deck and for the crew in the topgallant forecastle. Water ballast of ample capacity is provided in the cellular double bottom all fore and aft and in the fore and after peak-tanks. The vessel will be rigged as a two-masted schooner, and fully rigged with all the necessary deck machinery. The propelling machinery has been constructed and will be fitted by Messrs. Blair & Co., Ltd., of Stockton-on-Tees, and is of the latest improved triple-expansion type, supplied with steam by two large steel multitubular boilers. Both the ship and engines have been constructed by Lloyd's rules under special survey for their highest classification.

Arna.—On March 1st, Messrs. William Gray & Co., Ltd., launched the steel screw steamer *Arna*, which they have built to the order of Messrs. S. M. Kuhnle & Son, Bergen, Norway. She will take the highest class in the British Corporation Register, and is of the following dimensions, *viz.* :—Length overall, 422 ft. 6 in. ; breadth, 34 ft. ; and depth, 26 ft. 11 in., with two decks laid, long bridge, poop and topgallant forecastle. The saloon, state-rooms, captain's, officers' and engineers' rooms, etc., will be fitted up in houses on the bridge deck, and the crew's berths in the forecastle. The hull is built with deep bulb-angle frames, clear holds, cellular double bottom and large aft and fore-peak ballast tanks, ten steam winches exhausting into a winch condenser, steam-steering gear amidships, hand-screw gear aft, patent direct steam windlass, shifting boards, stockless anchors, telescopic masts with fore and aft rig, boats on deck overhead with Captain Gude's Patent Chocks and releasing gear, ventilation for the Eastern trade, electric light and all requirements for a first-class cargo steamer. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 27½ in., 43½ in. and 73 in. diameter, with a piston stroke of 48 in. and four steel boilers for a working pressure of 180 lbs. per square inch.

Edenor.—On March 2nd, Messrs. Osbourne, Graham & Co. launched from their yard at Hylton, the s.s. *Edenor*, which they have specially constructed to the order of The Edenor Shipping Co., Ltd., of Newcastle-on-Tyne, for whom Messrs. Gronquist, Bryan & Co. are managers. This vessel has been classed at Lloyd's 100 A1 under Special Survey, and her leading particulars are as follows :—Length, 252 ft. ; breadth, 34 ft. 3 in. ; poop, 20 ft. ; forecastle, 25 ft. She has been built upon the arch principle of construction, and has been designed and superintended by Mr. Maxwell Ballard, the patentee, through whom this order was booked, which is the first vessel to be constructed under the Ayre-Ballard Patents. She will carry about 2,200 tons deadweight. The general arrangement of accommodation is similar to the

ordinary type of vessel, and she is self-trimming in a more than ordinary degree, this being incidentally a property of the new form, which also lends itself to the ready construction of enormous hatchways. Four of these are provided in the *Edenor*, and they are of great size. A cargo poop is contructed aft with hatchways. Steam winches are specially arranged in a novel manner with double derrick gear for the rapid handling of cargo, and the vessel is replete in every way with the latest outfit and requirements. The redistribution of material effected by the design greatly increases the longitudinal strength of the vessel, and at the same time the form and structure entirely does away with all the usual required hold pillaring. Absolutely clear holds are thereby given, and, taking depth of hold as a factor, for freedom from obstruction, the new design in this respect is unrivalled. While the new form increases the strength by deepening the ship at the most vital position, it raises the deck platform above the water line to a much higher level. This will mean that less water can be shipped upon deck, and with the increased stability afforded by the redistribution and the very large increase of reserve buoyancy afforded by the new design, a much more comfortable sea boat is the resultant. After the launch the vessel proceeded to the works of Messrs. MacColl & Pollock, to receive her machinery, which consists of triple-expansion engines with cylinders 18 in., 29 in. and 48 in., with a stroke of 33 in., steam being supplied by two single-ended boilers 11 ft. by 10 ft., working at a pressure of 180 lbs. These engines will drive the vessel a speed of 9½ knots loaded at sea.

Erdely.—On March 2nd, there was launched from the Jarrow Yard of Messrs. Palmer's Shipbuilding and Iron Co., Ltd., the steel screw steamer *Erdely*, built to the order of The Hungarian Levant Steamship Co., Ltd., Budapest. The vessel is 370 ft. long, and will carry over 7,500 tons deadweight on her summer freeboard. She is of the single-deck type, and has been built to take the highest class in Lloyd's Register. She has cellular double bottom throughout for water ballast, which is also carried in the fore and after peaks. The vessel is to be fitted with triple-expansion engines, and three single-ended boilers working at 180 lbs. pressure.

Hans B.—On March 2nd, Messrs. William Gray & Co., Ltd., launched the handsome steel screw steamer *Hans B*, for A/s Borgen for whom they have built several vesselse registered abroad, under different heading. She will takg the highest class in Lloyd's Register, and is of the followin. dimensions, *viz.* :—Length overall, 377 ft. ; breadth, 50 ft. 9 in. ; and depth, 28 ft. 4½ in. ; with long bridge, poop and topgallant forecastle. The hull is built with deep bulb-angle frames, cellular double bottom and aft-peak tank. The vessel has eight steam winches exhausting into winch condenser, steam-steering gear amidships, hand-screw gear aft, patent direct steam windlass, large multitubular horizontal donkey boiler, shifting boards throughout, stockless anchors, telescopic masts with fore and aft rig, boats on deck overhead and a very complete outfit for a first-class cargo steamer. Triple-expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 26 in., 42 in. and 70 in. diameter, with a piston stroke of 48 in., and two large steel boilers for a working pressure of 180 lbs. per square inch.

Hydro.—On March 3rd, a handsomely-modelled steamer, the *Hydro*, built to the order of Messrs. Thos. Wilson, Sons and Co., Ltd., for the general Baltic trade, was launched from the yard of Messrs. Earle's Shipbuilding & Engineering Co., Ltd., Hull. The principal dimensions of the *Hydro* are :—Length, 250 ft. ; breadth, 35 ft. ; depth, 18 ft. moulded. She has been constructed of steel to the British Corporation Registry's highest class and to the Board of Trade latest requirements. The vessel is of single-deck type with short poop, long bridge, and topgallant forecastle, and will be fitted with two pole masts to suit Manchester Ship Canal Regulations, and is capable of carrying a large quantity of water ballast. A commodious deck-house has been provided on the bridge deck amidships for the accommodation of captain, officers, engineers and steward. She will be fitted with all necessary derricks and cargo gear, four steam winches, steam windlass, and steam and hand-steering gear. The sister vessel *Castro* was launched from the same yard a fortnight ago.

Neil Gow.—On March 3rd, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely-modelled steel screw trawler, the principal dimensions being :—126 ft. 8 in. by 22 ft. by 12 ft. 6 in. moulded. The vessel has been built to the order of The Orient Steam Fishing Co., Ltd., of Grimsby, and will be fitted with powerful triple-expansion engines by Messrs. C. D. Holmes & Co., Ltd., of Hull, and is replete with all the latest improvements for fishing purposes.

Phrontis.—On March 4th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely-modelled steel screw trawler, the principal dimensions being :—130 ft. by 23 ft. 6 in. by 13 ft. 3 in. moulded. The vessel has been built to the order of The Mount Steam Fishing Co., Ltd., of Fleetwood, and will be fitted with powerful triple-expansion engines by Messrs. Amos & Smith, Ltd., of Hull, and is replete with all the latest improvements for fishing purposes.

Gerona (to be re-named Asconia).—On March 4th, Messrs. Swan, Hunter & Wigham Richardson, Ltd., launched from their Wallsend Shipyard, Wallsend-on-Tyne, the twin-screw passenger steamship *Gerona*, the latest addition to the Cairn Line Steamships, Ltd., Newcastle-on-Tyne. This vessel embodies some of the features of the t.s.s. *Tortona*, recently built by Messrs. Swan, Hunter & Wigham Richardson for the same owners, but she is larger, has a great deal more passenger accommodation, and in every way has been improved to meet the increasing requirements of the services between England, Canada and Italy. The *Gerona* is built to the classification of Lloyd's, 100 A1, and she will comply with all the requirements of the Board of Trade, the United States Laws for carrying passengers, and the Italian Emigration Laws. The vessel is rigged as a two-masted fore and aft schooner and has two funnels. There is a complete shelter deck from stem to stern, and about it a poop, a long bridge and a topgallant forecastle. Deep web frames have been provided instead of hold beams, giving not only increased strength, but also leaving the holds clear for carrying bulky cargo, such as large machinery. Amidships there will be luxurious accommodation for about 140 first-class passengers, and on the shelter and in the upper 'tween decks there are berths for about 1,500 third-class passengers, together with ample dining accommodation. Throughout the vessel there will be ample provision of fire-extinguishing pipes with a complete outfit of hose pipes. The electric installation will give lighting throughout the ship and also serve wireless telegraphy apparatus. All the sanitary fittings in the vessel are to pass the regulations of the Board of Trade, and also the American and Italian Emigration rules. There will also be hospitals for ordinary and infectious cases, an operating room and a dispensary. A special feature of the emigrants' living quarter is a complete installation of the well-known thermo-tank ventilating and heating plant. The fans will be sufficient to renew the air eight times an hour. The fans can be reversed at will so as either to draw the air out of the different parts of the ship or to inject fresh air, either cool or warm. The captain, officers and engineers will have comfortable accommodation on the boat deck. The seamen and firemen instead of having their living quarters in the forecastle, as is usual, will be more comfortably installed on the shelter-deck at the after end of the vessel. The twin-screw triple-expansion engines and also the boilers are being constructed by Messrs. Palmer's Shipbuilding & Iron Co., of Jarrow. The boilers will be worked with Howden's forced draught. The *Gerona* has a large cargo capacity, an ample equipment of winches and derricks being provided to handle goods expeditiously. A considerable portion of cargoes from Canada will be food supplies, and refrigerated holds will be provided for these, the necessary low temperature being maintained by means of Messrs. J. & E. Hall's well-known carbon di-oxide process.

Ceiba.—On March 7th, the steamer *Ceiba*, the latest addition to the fleet of fruit steamers plying between the United States and Central America, was launched from the Neptune Works of Messrs. Swan, Hunter & Wigham Richardson, Ltd. The vessel is a finely-modelled steel screw steamer, 270 ft. in length by 39 ft. beam, and is intended to take the highest class of Lloyd's Register. The greatest care has been exercised in her design, in order to obtain the best conditions for

carrying fruit. A great number of ventilators are fitted both to the holds and 'tween decks, so that the cargo may be safely borne through the tropics. Accommodation for first-class passengers is provided amidships. There are two *cabines de luxe*, and state-rooms for thirty passengers. A special feature of the accommodation is a large shelter on deck, fitted with seats and tables, and protected from the weather. The ventilation of the passenger accommodation has been the subject of careful thought. The *Ceiba* has an installation of wireless telegraphy. The machinery and boilers have also been constructed at the Neptune Works. The steamer has powerful triple-expansion engines, intended to drive her at a high rate of speed.

City of Lahore.—On March 14th, there was launched from the Wallsend shipyard of Messrs. Swan, Hunter & Wigham Richardson, Ltd., the latest addition to the Hall Line section of Ellerman's City Line, which maintains the well-known passenger and cargo service between Glasgow, Liverpool and Calcutta, touching at various intermediate ports. The propelling machinery, constructed by the Wallsend Slipway and Engineering Co., Ltd., consists of a set of quadruple-expansion engines, with substantial boiler power. The dimensions of the ship are :—Length, 450 ft. ; breadth, 54 ft. ; and moulded depth, 33 ft. 10 in. The deadweight capacity will be over 10,000 tons. There will be a complete installation of electric light and heating apparatus throughout the living accommodation. On the bridge and boat decks apartments will be provided for about seventy first-class passengers, and in the poop for forty second-class. The public rooms will be very superior in character. Both classes are provided with abundant bath-rooms and lavatory accommodation, with hot and cold fresh and salt-water services.

Trevorian.—On March 15th, there was launched from the shipbuilding yard of Messrs. John Readhead & Sons, Ltd., West Docks, South Shields, a steel screw steamer, built to the order of Messrs. Edward Hain & Son, St. Ives, Cornwall, and named the *Trevorian*. The vessel is of the improved single-deck type to Lloyd's highest class, and under their special survey, having poop, extra long bridge, and topgallant forecastle, with deep girder framing, and having cellular double bottom all fore and aft, with large after-peak tank for water ballast. The outfit of the ship is very complete for general and grain trades, with shifting boards all fore and aft, and trunk feeders as hatchways. A full equipment of steam winches and derricks is fitted for the rapid loading and discharging of cargoes. She will carry a deadweight cargo of 7,550 tons on a light draught of water. The vessel will be fitted with triple-expansion engines, also constructed by Messrs. John Readhead & Sons, Ltd., having cylinders 26 in., 42 in. and 69 in., and 48 in. stroke, steam being supplied from two large steel boilers working at a pressure of 180 lbs. per square inch. This is the fifty-fourth vessel built for the above firm by Messrs. John Readhead & Sons, Ltd.

Halvdan.—On March 16th, Messrs. Sir Raylton Dixon and Co., Ltd., launched from their Cleveland Dockyard, Middlesbrough, a fine steel screw steamer which they are building to the order of Messrs. Bruusgaard, Kiosterud & Co., of Drammen, Norway. The vessel is being constructed under special survey to class 100 A1 at Lloyd's, and to pass Norwegian Veritas, and is of the single-deck type with poop, long bridge and forecastle. Her principal dimensions are :—372 ft. by 52 ft. 6 in. by 26 ft. 5 in. moulded, and she will have a deadweight carrying capacity of about 7,400 tons on a light draught of water. Saloon and captain's room will be fitted up in a large steel house amidships, with chart room and office on top, and flying bridge above this. The officers' and engineers' accommodation will be provided in side houses abreast engine casing, while the firemen and crew will be located aft in poop. The vessel has four holds, five hatches, two masts, and will be equipped with ten derricks, ten steam winches, steam windlass, two large donkey boilers, hand and steam-steering gear and all the latest and most modern appliances for the rapid handling of cargo. Triple-expansion engines having cylinders 25 in., 41 in. and 68 in. by 48 in. stroke, supplied with steam by two very large single-ended boilers working at 180 lbs. pressure, will be fitted by the North-Eastern Marine Engineering Co., Ltd., Wallsend-on-Tyne.

Persimon.—On March 16th, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely-modelled steel screw trawler, the principle dimensions being :—126 ft. 8 in. by 22 ft. by 12 ft. 6 in. moulded. The vessel has been built to the order of Mr. W. J. Barrett, of Grimsby, and will be fitted with powerful triple-expansion engines by Messrs. C. D. Holmes & Co., Ltd., of Hull, and is replete with all the latest improvements for fishing purposes.

Y.C. No. 95.—On March 16th, a steel screw steamer *Y.C. No. 95*, constructed by Messrs. Earle's Shipbuilding and Engineering Co., Ltd., for the British Admiralty, was successfully launched. The principal dimensions are :—Length, 110 ft. ; breadth, 24 ft., and depth, 12 ft. The vessel is the first of its type built for the Admiralty, and has been constructed to the builders' own design and specification under Admiralty Survey, for transporting ashes from battleships in docks or rivers and discharging them at sea. For this purpose a hopper has been built forward capable of carrying about 100 tons of ashes. The bottom has been arranged in large sections to hinge down, worked by quick-acting winches on deck, geared to a powerful windlass. Combined steam and hand-steering gear is fitted amidships. Accommodation is provided in spacious cabins for twelve men. The machinery consists of triple-expansion engines capable of driving the vessel at a speed of 9 knots. Steam is supplied by one large cylindrical boiler. The vessel was launched complete with machinery and all fittings on board ready for trials.

Monkshaven.—On March 17th, Messrs. Wm. Doxford and Sons, Ltd., launched from their yard at Pallion, Sunderland, a vessel built to the order of The Eskside S.S. Co., Ltd. (Messrs. Chas. Smales & Son), Whitby. The dimensions are :—Length, 346 ft. ; breadth, 48½ ft. ; moulded depth, 25¾ ft. Deadweight capacity, 5,800 tons. The engines and boilers are being constructed by Messrs. Doxford. The *Monkshaven* has been built under the inspection of Mr. J. McCoy, and is to be classed 100 A1 at Lloyd's.

Two Steel Lighters.—On March 17th, two steel lighters 50 ft. by 16 ft. by 7 ft., were launched from the yard of Messrs. Edward Finch & Co., Ltd., Bridge Works, Chepstow. These are the last two of an order for eight similar craft. They have been towed to Liverpool in pairs, from whence they have been shipped at fortnightly intervals, also in pairs, on the deck of a Lamport Holt steamer to their destination, Bahia.

LAUNCHES—Scotch.

Star of Freedom.—On February 18th, there was launched at Aberdeen a steam trawler named *Star of Freedom*, which has been built to the order of the Walker Steam Trawling Co., Ltd., Aberdeen. The dimensions are :—Length, 125 ft. ; breadth, 23 ft. ; and depth, 13 ft. 9 in. Steel boiler and triple-expansion engines will be fitted by the builders. The *Star of Freedom* is the largest trawler ever constructed at Aberdeen.

Baron Polwarth.—On February 27th, Messrs. Napier and Miller, Ltd., launched from their yard at Old Kilpatrick the steel screw steamer *Baron Polwarth*, built to the order of Messrs. H. Hogarth & Sons, Glasgow, to carry fully 8,000 tons on 24 ft. with large hatches, clear holds, nine steam winches, electric light and deep ballast tanks. The dimensions of the vessel are :—Length, 400 ft. ; breadth, 52 ft. ; depth, 30 ft., with a gross tonnage of about 5,000 tons, built to the British Corporation requirements for their highest class. The machinery is being supplied by Messrs. Dunsmuir and Jackson, Ltd., and consists of triple-expansion engines having cylinders 27 in., 43 in. and 72 in. by 48 in. stroke, also two main boilers and a donkey boiler. Messrs. Wailes, Dove and Co.'s " Bitumastic " covering was applied to tank top under boilers and donkey boiler recess, and their " Bitumastic " Enamel to bunkers, boiler-room tank and bilges in engine and boiler-rooms. A Cochran (Annan) donkey boiler with patent seamless furnace has been supplied and fitted.

Coila.—On February 28th, there was launched at Dumbarton the steel screw steamer *Coila* for Liverpool owners. The vessel is constructed on the Isherwood principle, and is of the single-deck type, with long bridge, poop and forecastle. The dimensions are :—Length, 382 ft. ; breadth, 51 ft. ; depth moulded, 27 ft. 8½ in. Both the vessel and her machinery have been built under special survey of Lloyd's for their highest class.

Satyavati.—On February 28th, there was launched on the Clyde a screw steamer, built for the pilgrim and passenger service of the Bombay Steam Navigation Company. The vessel is 185 ft. in length between perpendiculars, 27 ft. 6 in. in breadth, and 17 ft. in depth, moulded. Triple-expansion engines will be supplied.

Saint Stephen.—On March 2nd, there was launched on the Clyde a steel screw steamer, built to the order of Messrs. Rankin, Gilmour & Co., Ltd., of Liverpool. The principal dimensions are :—Length, 390 ft. ; breadth, 52 ft. ; depth, 28 ft. to upper deck ; deadweight, 7,300 tons. The vessel will have triple-expansion engines having cylinders 25 in., 41 in. and 68 in., by 48 in. stroke, taking steam from three single-ended boilers. The vessel, which is built on the Isherwood system, will have Lloyd's highest class.

Andorinha.—On March 2nd, the latest addition to the fleet of the Yeoward Line, of Liverpool, was launched at Dundee. The steamer, which has been built to Lloyd's highest class and Board of Trade requirements, is intended for service in the owners' line running between Liverpool, Lisbon, Madeira and the Canary Islands, and has been specially designed to give passengers every comfort. She is 290 ft. in length and 41 ft. 6 in. in beam, and will carry about 3,000 tons of cargo, in addition to about 100 first-class passengers. The steamer is also specially adapted for the transport of bananas from the Canaries. The propelling machinery consists of a set of triple-expansion engines, capable of driving the vessel up to 15 knots, supplied with steam from three single-ended boilers. The auxiliary machinery for working the vessel and her cargo is of the most approved description, and includes a large refrigerating plant. It is understood that the vessel is to be fitted for wireless telegraphy and that very shortly she will be ready for service.

Manzanares.—On March 4th, Messrs. Alex. Stephen & Sons, Ltd., Linthouse, launched a finely-modelled steamer for the fruit trade of Messrs. Elders & Fyffes, Ltd., between the West Indies, Central America and Manchester. The vessel has a length of 390 ft. by 48 ft. beam, and a depth of 32 ft., with a gross tonnage of about 4,200, and is somewhat similar in design to the three previous steamers built by Messrs. Stephen for the same owners. The passenger accommodation is excellent, consisting of a large saloon house on deck, with saloon, music-room, smoking-room, etc. The officers and engineers are also housed on this deck. The principal feature of the vessel is the insulated hold storage of 200,000 cubic ft. capacity, cooled by refrigerating machinery on the CO_2 system by Messrs. J. & E. Hall, of Dartford, for bringing bananas, oranges, etc., from the West Indies to this country. She is fitted with triple-expansion engines, having cylinders 27 in., 45 in. and 75 in. diameter by 54 in. stroke. Facilities for the rapid loading and discharging of cargo are provided. A Cochran (Annan) donkey boiler with patent seamless furnace has been supplied and fitted.

Medina.—On March 15th, the *Medina*, one of the two new steamers of the "M" class now building for the P. & O. Company, was successfully launched from Messrs. Caird and Co.'s yard at Greenock. The naming ceremony was performed by Lady Alice Shaw-Stewart. The completion of this ship and her sister, the *Maloja*, will bring the P. & O. Company's "M" class of steamers to a total of ten. The two new vessels are designed for the Company's India, China and Australia mail and passenger services, and will probably make their maiden trips in November to India. Messrs. Wailes, Dove & Co.'s "Bitumastic" enamel was applied to the bunkers and ballast tanks, and their "Bitumastic" covering to tank top in boiler-room and deck in refrigerating machine-room. Messrs. Matthew Keenan & Co., Ltd., have the contract to insulate the engine and boiler-room casing with their patent bulkhead insulation, and the boiler and steam pipes with their patent non-conducting vegetable pulp.

Burma.—Recently the Greenock and Grangemouth Dockyard Company launched for the Admiralty the steamer *Burma*, the first oil-tank steamer constructed to the order of the Admiralty. This vessel, which is intended to supply oil to the British Fleet at sea, will carry 2,500 tons fuel oil in twelve tanks. The propulsive machinery is by Messrs. J. G. Kincaid & Co., Greenock. When steaming at sea, she will have a speed of 12 knots. She is understood to be capable of towing a vessel and supplying her with oil fuel, or of being towed by warships and supplying them with oil fuel at the same time. She is fitted so as to supply oil to vessels alongside, both on port and starboard sides, from four different positions. In the pump-room are two powerful pumps capable of discharging 400 tons of oil per hour. By means of a complete system of oil pipes and valves the entire cargo of oil can be taken in, or discharged, by the operator in the pump-room, the pumps acting separately or together. A powerful steam-driven fan, also in pump-room, frees the tanks from the heavy, dangerous vapours which remain when oil is discharged. This enables the crew to clean the tanks with perfect safety. The vessel is fitted with a complete installation of electric light and steam heating.

LAUNCHES—Irish.

Egra.—On March 14th, at high water, the twin-screw steamer *Egra* was launched by Messrs. Workman, Clark & Co., Ltd., Belfast, from their South Yard. The *Egra* has been built to the order of the British India Steam Navigation Co., Ltd., and is 424 ft. in length, with a gross tonnage of 5,000. Accommodation is provided in large and comfortable state-rooms on the shade deck for about fifty first-class and forty second-class passengers, the rooms being arranged for one, two and three persons, while the 'tween deck spaces have been arranged for the accommodation of native steerage passengers. The first-class public rooms are all situated on the bridge deck, and include a dining-saloon, social hall, and a smoke-room, all artistically fitted and furnished, while for the second-class passengers there is a large dining saloon on the shade deck. Careful consideration has been given to the ventilation of the passenger accommodation, so as to ensure the utmost comfort of passengers in the tropical regions in which the vessel is intended for service. Cargo is carried in three holds, the two forward holds being practically free from obstruction owing to the adoption of the girder principle of construction, and therefore available for large consignments, such as boilers and machinery. The hatchways to each hold are exceptionally large, and are equipped with the necessary steam winches, derricks and other gear capable of expeditiously handling a full general cargo. The propelling machinery consists of two independent sets of triple-expansion engines with the latest improvements and all the necessary auxiliaries, steam being generated in four large steel horizontal cylindrical boilers working under forced draught. The vessel has been constructed under Lloyd's survey for the highest class in their Registry, while the British Board of Trade requirements for a first-class passenger steamer have also been fully complied with.

TRIAL TRIPS.

Koophandel.—On March 16th, the s.s. *Koophandel* proceeded on her official trial trip in Hartlepool Bay. Owing to the inclement weather it was impossible to attempt a speed trial, but the machinery and all auxiliaries worked very satisfactorily. She was launched from the Harbour Dockyard of Messrs. Irvine's Shipbuilding & Dry Docks Co., Ltd., West Hartlepool, on 14th February, and is a steel screw steamer built to the order of Messrs. Furness, Withy & Co., Ltd., West Hartlepool, for the Scheepvaart Maatschappij Gylson, Antwerp. The dimensions are :—289 ft. 6 in. by 40 ft. 2 in. by 20 ft. 6½ in. The vessel has a single deck, poop, bridge and topgallant forecastle, and has been built to the British Corporation Registry's highest class. A double bottom is fitted throughout on the cellular principle, and the after peak is arranged as a trimming tank. She is constructed with bulb angle frames and longitudinal stringers, giving clear holds for the stowage of bulky cargoes. Four watertight bulkheads divide the vessel into five watertight compartments. There are four large cargo hatches, with a steam winch to each, the bulwarks have been specially strengthened for the carriage of deck cargoes, and the vessel is replete with all the latest improvements for loading and discharging expeditiously. A powerful quick-warping steam windlass is fitted forward for working the cables, and steam-steering gear is fitted amidships, with hand-screw gear aft, and a large multitubular donkey boiler is also fitted. The cabins are heated with steam, and the sanitary ventilating and lighting arrangements are effected on the most improved lines. Triple-expansion engines will be supplied and fitted

by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, having cylinders 20½ in., 33 in., 54 in. by 36 in. stroke, with two large single-ended boilers, working at a pressure of 180 lbs. per square inch. A Cochran (Annan) donkey boiler with patent seamless furnace has been supplied and fitted.

Carmen.—On March 11th, the s.s. *Carmen* ran a successful sea trial, when a mean speed of 11¾ knots was attained. The vessel was launched by Messrs. Wm. Doxford & Sons, Ltd., on February 14th, from their yard at Pallion, Sunderland, and she is a large vessel built to the order of Oscar de Lucovich, Esq., of London. The dimensions are :—Length, 370 ft. ; breadth, 50 ft. ; moulded depth, 28¾ ft. ; and deadweight, 7,550 tons. The vessel is classed 100 A1 at Lloyd's. The engines and boilers have also been supplied by Messrs. Doxford.

Vendee.—On February 25th, the fine steel screw passenger and cargo steamer *Vendee*, built by Messrs. Sir Raylton Dixon & Co., Ltd., at their Cleveland Dockyard, Middlesbrough, to the order of Messrs. James Moss & Co., of Liverpool, proceeded to sea for her official trials. The trials passed off most successfully and the vessel proceeded to the Tyne, whence she will sail on her maiden voyage under the command of Captain Muir. See also Launches, February issue.

Daphne.—On March 1st, the new steamer *Daphne*, built by the Sunderland Shipbuilding Co., Ltd., proceeded on her official trial. After proceeding to sea, the vessel made several runs over the measured mile, fully loaded, when a mean speed of 10¾ knots was obtained ; after this a continuous speed trial was run, which gave entire satisfaction to all on board. After the trial the vessel proceeded on her voyage to Caen. See also Launches, March issue.

Amphion.—On March 1st, the s.s. *Amphion*, of about 5,500 tons deadweight, built for Messrs. J. & P. Hutchison, Glasgow, by the Campbeltown Shipbuilding Company, Campbeltown, and engined by Messrs. David Rowan & Co., Glasgow, ran trials at Wemyss Bay. The *Amphion* is of the single-deck type, with clear holds, and has poop, long bridge and topgallant forecastle. She has been constructed in excess of Lloyd's highest class and is specially arranged for the owners' grain and general trade. The trial proved quite satisfactory, and a mean speed of over 11 knots was obtained. The *Amphion* is the third steamer recently built by the Campbeltown Shipbuilding Co. for Messrs. Hutchison.

Aracataca.—On March 3rd, this vessel left the Alexandra Wharf and steamed down Belfast Lough for adjustment of compasses and to undergo her speed trials on the measured mile course. After the adjustment of compasses the various trials took place and these were highly successful, a speed well in excess of the contract requirements being attained. The vessel afterwards proceeded to Glasgow to take in bunker coal, and will leave that port for the West Indies in the course of a few days. See also Launches, February issue.

Arabien.—On March 4th, the steamer *Arabien*, which has been constructed at the Neptune Works of Messrs. Swan, Hunter & Wigham Richardson, Ltd., for Det Ostasiatiske Kompagni, of Copenhagen, sailed from the Tyne on the conclusion of a highly satisfactory trial trip. On the trial trip the machinery gave the greatest satisfaction to all concerned. Immediately on the conclusion the vessel sailed for Copenhagen, under the command of Capt. Cortsen, whence she will take up her station on the Company's service between Europe and the Far East. See also Launch, March issue.

Berwindvale.—On March 4th, the s.s. *Berwindvale* left the Tees for her delivery trial, having on board Mr. John Esplen, representing the owners, Mr. Harold R. Dixon and Mr. Harroway representing the builders, Messrs. Sir Raylton Dixon & Co., Ltd., Middlesbrough-on-Tees, and Mr. Morison, representing the engine-builders, Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool. One of the important features of the steamer is her very large hatchways, which, eight in number, measure 21 ft. by 33 ft. This practically leaves the whole of the ship open when the hatches are removed. An entirely new design of hinged hatch cover has been adopted and although the hatchways are of such an enormous size, the covers by a very simple arrangement may be raised and lowered in a space of ninety seconds, and no tarpaulins are required. When one considers the time that must be employed in removing tarpaulins and wood hatch covers of hatchways of this size, it will be recognised what a great advance has been made, for with two men this operation has been reduced to a minimum. On the trial trip the vessel, in half-loaded condition, averaged a speed of 13 knots. See also Launches, January issue.

Lauderdale.—On March 14th, the s.s. *Lauderdale*, of about 2,000 tons deadweight, built to the order of The Union Steamship Company of New Zealand, Ltd., by the Campbeltown Shipbuilding Co., Campbeltown, and engined by Messrs. David Rowan & Co., Glasgow, ran trial at Wemyss Bay. The *Lauderdale* is of the well-deck type with raised quarter-deck, bridge and topgallant forecastle. She has a complete installation of electric light, double winches and derricks to each hatchway, and has been specially arranged for the owners' New Zealand long-coasting trade. After the trials, which were highly satisfactory, the *Lauderdale* proceeded to Liverpool to finish loading before clearing for the voyage out to New Zealand. A mean speed of over 10½ knots was easily maintained.

Ferngarth.—On March 4th, the steel screw steamer *Ferngarth*, built by Messrs. Craig, Taylor & Co., Ltd., Stockton-on-Tees, to the order of The Clapham Steamship Co., Ltd. (Messrs. Henry Clapham & Co., Newcastle, managers), was taken to sea for her trial trip, which proved highly satisfactory. The vessel is of the following dimensions, *viz.* :—392 ft. by 52 ft. by 29 ft. 6 in. moulded. She is built of steel to the highest class in Lloyd's registry under special survey, and has poop, bridge, and topgallant forecastle, water ballast in double bottom fore and aft, and in peaks. She is fitted with patent direct steam windlass with quick warping ends, steam-steering gear, eight steam winches, shifting boards in holds for carrying grain cargoes, telescopic masts to Manchester Ship Canal requirements, double derricks, and all the latest improvements for rapid loading and discharging. The accommodation for captain, spare room and officers is neatly fitted up in deck-house amidships, the engineers being in deck-house alongside engine casing, and the crew under the bridge. Her engines have been built by Messrs. MacColl & Pollock, Ltd., at the Wreath Quay Engineering Works, Sunderland, the cylinders being 25½ in., 43 in., and 70 in. by 45 in. stroke, steam being supplied by three extra large boilers designed and constructed for the working pressure of 180 lbs. per square inch. The condenser is arranged entirely separate from the main engines, so that it can be used for auxiliary purposes in port. Particular attention has been given to the removal of impurities from the feed water, duplicate filters being fitted so that no water is allowed to enter the boilers without being efficiently filtered. The vessel is fitted with extra large ballast pump, feed heater, large evaporator, and other usual fittings. During the trial everything worked with the greatest smoothness, and a speed of 12¾ knots was maintained, the vessel being in half loaded trim. Immediately after the trial, the vessel proceeded on her way, under command of Captain R. J. Smith.

Daksa.—On March 6th, the new screw steamer *Daksa*, built by Messrs. John Readhead & Sons, Ltd., West Docks, South Shields, to the order of the Navigazione a Vapore "Unione" of Dubrovnik, was taken to sea on her official trial trip. After the trial, which was in every way satisfactory to all concerned, the vessel proceeded to Blyth to load for Trieste, under the command of Capt. V. Milos. See also Launches, March issue.

Tellus.—On March 8th, the s.s. *Tellus*, built and engined by Messrs. Wm. Doxford & Sons, Ltd., Sunderland, to the order of Wilh. Wilhelmsen, Esq., of Tönsberg, ran a successful sea trial, when a mean speed of 12¼ knots was obtained. There were present at the trial, Mr. Geo. Stout, representing charterers ; Capt. Edvardsen, representing owners ; and Mr. Nicol, of Messrs. C. A. Bushell, Nicol & Co., of Newcastle. After the trial the vessel went to the Tyne for bunkers. See also Launches, March issue.

Walter Dammeyer.—On March 9th, the new steamer *Walter Dammeyer*, built by the Sunderland Shipbuilding Co., Ltd., proceeded on her official trial. After proceeding to sea, the vessel made several runs over the measured mile, fully loaded, when a mean speed of 10½ knots was obtained, which was considered most satisfactory. See also Launches, March issue.

August.—On March 9th, the large steel screw steamer *August*, built by Messrs. Wm. Gray & Co., Ltd., to the order of Mr. Jacob Christensen, of Bergen, had her trial trip. The ship was put through the usual manœuvres, everything working smoothly and well, and the speed of ship being 12¼ knots. The vessel afterwards proceeded on her voyage. See also Launches, March issue.

Messina.—On March 9th, the steel screw steamer *Messina*, built by the Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne, to the order of Messrs. Furness, Withy & Co., Ltd., West Hartlepool, left the Tyne for her official trial trip. The trial trip proved in every way satisfactory, and a speed of 11½ knots was obtained. See also Launches, March issue.

Anchises.—On March 10th, the twin-screw steamer *Anchises*, built and engined by Messrs. Workman, Clark & Co., Ltd., for Messrs. Alfred Holt & Co., for the newly established passenger service to Australia, proceeded down the Lough for adjustment of compasses, machinery tests and speed trials. After these tests, which were all thoroughly satisfactory, the vessel left for Glasgow, where she will load cargo and leave for the initial voyage to Australia, calling at Fishguard to take passengers on board. See also Launches, February issue.

FOREIGN LAUNCH.

Ull.—On March 2nd, The Laxevaags Engineering & Shipbuilding Company, Bergen, Norway, launched the s.s. *Ull*, built to the order of Messrs. Johan C. Giertsens Eftf. Bergen. The principal dimensions are :—Length overall, 239 ft. 6 in. ; breadth, 35 ft. ; depth moulded, 16 ft. 10 in. The machine is also built by the Laxevaags Company ; the cylinders being 16 in. by 25½ in. by 43 in. by 30 in. stroke, and the working pressure 175 lbs. per square inch.

FOREIGN TRIAL TRIP.

Ihumata.—On March 2nd, the fine new steel screw steamer *Ihumata*, built by The Antwerp Engineering Co., Ltd., Hoboken-lez-Anvers, for The Union Steamship Co., of New Zealand, Ltd., had her official trial trip off Flushing, when the vessel gave every satisfaction, the machinery working splendidly throughout, a mean speed of 10¼ knots being easily maintained. Afterwards the vessel proceeded to Norway, to load her first cargo. This vessel, which is the first English steamer built in Antwerp, is 230 ft. long, 35 ft. 6 in. beam, by 16 ft. 10½ in. deep, has two holds, eight steam winches, steam windlass and suitable appliances to suit the owners' trade. The propelling machinery, which has been constructed at the Northumberland Engine Works, Wallsend-on-Tyne, of The North-Eastern Marine Engineering Co., Ltd., consists of a set of their latest type of triple-expansion engines, having cylinders 17 in., 28 in. and 46 in. by 33 in. stroke, steam being supplied by a large steel boiler working at a pressure of 180 lbs. per square inch. A number of visitors accompanied the vessel on her trial run.

BOARD OF TRADE EXAMINATIONS.

NOTE—1C denotes First Class : 2C Second Class.

February 23rd, 1911.

Aitchisen, A. .. 2C Liverpool
Allan, F. ..... 1C N.Shields
Alexander, T.W. 1C Glasgow
Black, W. S. .. 2C Leith
Bogan, J. W. .. 1C Cork
Brabban, A. .. 1C London
Brawley, J. .... 1C Cardiff
Bruce, R. R. .. 1C Liverpool
Calder, D. .... 2C Liverpool
Carnochan, G.A 2C Liverpool
Carter, T. M. .. 1C London
Cunningham, A. 1C Liverpool
Davison, J. .... 2C N.Shields
Dowling, W. .. 2C Glasgow
Duncan, C. C. 2C W. Hart'l
Dunn, D. ..... 1C Leith
Edmond, H. A. 2C Plymouth
Elstob, B. W. 2C W. Hart'l
Fallon, A. .... 1C London
Fowler, H. S... 2C Leith
Fyfe, D. ..... 1C Leith
Gillam, W. .... 2C Leith
Hart, F. A. .... 2C Hull
Hood, R. P. .. 2C Leith
Hudson, E. .... 2C Hull
Irving, J. M. .. 1C Liverpool
Johnson, C. W. 2C Hull
Kinloch, A. S. 2C Leith
Lake G. H. .. 1C Cardiff
Lee, H. G. .... 2C London
McCallum, J.W. 2C Glasgow
McCulloch, A.J. 1C Cardiff
Montgomery, N. 2C Liverpool
Morely, F. C... 1C W. Hart'l
Muirhead, A. .. 2C Glasgow
Newman, S. B 2C London
Oldfield, J. E. 1C Liverpool
Parker, W. W. 1C N.Shields
Paton, H. .... 1C Liverpool
Phillips, T. M. 2C Cardiff
Prestwich, J. D. 1C Liverpool
Proudlock, G.A. 1C Glasgow
Pugh, W. J. .. 1C Cardiff
Ramsey, G. .... 2C W. Hart'l
Rankeillor, J. .. 1C Leith
Robson, D. M 2C N.Shields
Ross, D. O. .... 2C W Hart'l
Seymour, R. W 1C N.Shields
Sharp, A. ..... 1C Leith
Squires, H. .... 2C W. Hart'l
Stevenson, W.C. 2C N.Shields
Stuart, A. J. .. 1C Leith
Thurlow, C. C. 2C London
Urruchua, M... 2C Plymouth
Wallace, A. A. 1C Barrow
White, G. N. .. 2C N.Shields
Williams, R. B. 2C W. Hart'l
Wood, G. A. .. 2C London

March 2nd.

Adamson, W.W. 2C London
Armstrong, T. 1C N.Shields
Beatty, N. S. .. 1C N Shields
Beggs, J. ..... 2C Liverpool
Best, W. E. .. 2C London
Boyd, J. ..... 2C Liverpool
Brown, C. .... 2C Greenock
Connolly, J. .. 2C Sunderl'd
Cook, J. ..... 2C Sunderl'd
Cowell, W. .... 1C Aberdeen
Craske, H. L .. 1C Liverpool
Cummins, H. L. 2C N.Shields
Currie, A. W... 1C Aberdeen
Dean, K. R. .. 1C Aberdeen
Fernandes, T.G. 2C N Shields
Flett, J. R. .... 1C Greenock
Freeman, T. .. 2C London
Hughes, A. .... 2C Liverpool
Hutchinson, R. 1C Londn'ry
Kerr, M. ..... 1C Greenock
Kirkpatrick, J. 2C Londn'ry
Kydd, W. .... 1C Liverpool
Lang, G. A. .. 1C N.Shields
Lumsden, J. H. 2C Sunderl'd
Macintyre, R.C. 1C Greenock
McClelland, H.R. 1C Greenock
Milne, A. C. .. 1C Aberdeen
Murray, W. C. 2C Aberdeen
Palmes, B. .... 2C Greenock
Quine, J. L. .. 1C Liverpool
Ramm, T. W. 2C N.Shields
Smartt, T. W. 2C London
Smyth, S. .... 1C Londn'ry
Tyre, T. D. .... 1C Greenock
White, L. G. .. 2C Bristol
Willing, W. .. 2C Sunderl'd

March 9th.

Adamson, G. .. 1C Glasgow
Barton, W. C. 1C Liverpool
Burch, H. .... 1C Liverpool
Campbell, J. .. 2C Glasgow
Craig, W. .... 1C Glasgow
Davies, I. ..... 2C Cardiff
Evans, J. O. .. 1C Cardiff
Galbraith, F. .. 1C Liverpool
Gifford, A. S. .. 1C Leith
Hardy, E. .... 1C N.Shields
Hewitt, A. H... 1C Liverpool
Hourston, A. G. 2C Leith
Jones, D. ..... 2C Cardiff
Lawrie, R. .... 1C Leith
Lee, W F. .... 2C London
Lewis, J. M. .. 1C Cardiff
Lockhart, H. .. 1C Glasgow
MacKellar, D.I. 2C Belfast
Mailer, J. ..... 1C Glasgow
McMurran, J. S. 2C N.Shields
McNeill, M. .. 2C South'ton
McVicar, G. J. 2C Glasgow
Melville, T. H. 2C Liverpool
Muchmore, H.J. 2C Cardiff
Owen, D. L. .. 1C Cardiff
Pont, C. ..... 2C London
Reedie, G. .... 1C Leith
Reid, G. W. .. 2C London
Simpson, A. E. 1C N.Shields
Smith, R. H. .. 1C Glasgow
Swanston, M. .. 1C London
Swift, H. ..... 2C Liverpool
William, R. M. 2C Liverpool
Wilson, H. M. 1C Belfast
Young, C. A. .. 2C London

March 16th

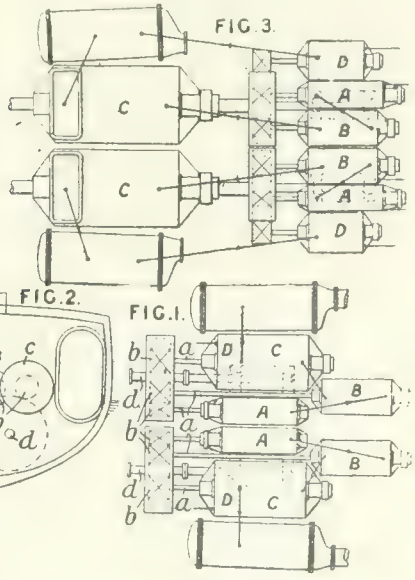
Barwise, J. .... 2C Liverpool
Birse, G. C. .. 2C Dundee
Bonne, S. E. .. 2C Hull
Boyes, W. M... 2C Greenock
Clark, R. B. .. 2C N.Shields
Fairweather, R. 1C Greenock
Hughes, H. ..... 2C Liverpool
Hutchison, S.M. 2C Greenock
Jack, H. P. .... 2C Dundee
Lamb, A. P. .. 2C Greenock
Lawrence, H.G. 1C Hull
Lloyd, E. T. .. 1C Liverpool
McPhail, E. A. 2C Liverpool
McQueen, D. .. 2C Liverpool
Michell, H. .... 2C London
Odonko-Quaddy, G. 2C London
Osborne, W. F. 1C Greenock
Smith, R. M. .. 2C N.Shields
Spence, G. M. 2C Greenock
Titjen, M. G. .. 1C London
Waugh, A. .... 1C N.Shields
Webb, F. ..... 1C Liverpool
Wing, J. ..... 1C Hull

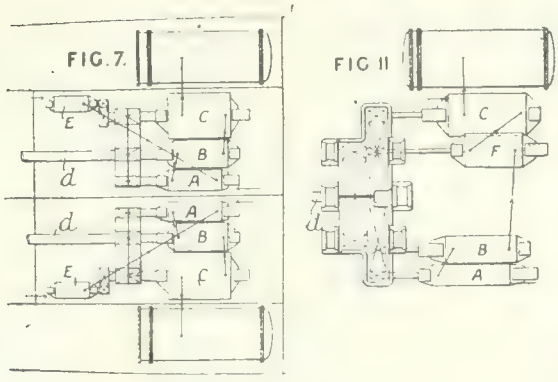
The Marine Engineer and Naval Architect Patent Record.

Compiled by Messrs. E. P. Alexander & Son, Chartered Patent Agents, 306, High Holborn, London, W.C.

25,651. Turbines. Relates to turbine installations wherein each separate turbine is designed to run at its most economical speed, the differently speeded turbines being suitably geared to drive a common shaft, as described in Specification No. 12,706, A.D. 1906, and consists in improved systems of the type suitable for marine propelling-plant. In certain cases, some of the turbines are directly coupled to the shafts, and, in other cases, some or all of the turbines transmit their power through double reduction gearing. In a two-shaft installa-

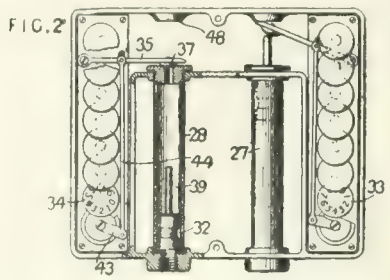
tion, two sets of turbines A, B, C, Figs. 1 and 2, are used. Each turbine is mounted on a separate shaft *a*, carrying a pinion *b*, which engages a large wheel *c* mounted upon the propeller shaft *d*. Astern turbines D are incorporated in the same casings as the low-pressure turbine C. In a modification, the high-pressure turbines A, Fig. 3, the intermediate-pressure turbines B, and the astern turbines D, drive through reduction gearing, the low-pressure turbines C being mounted directly upon the propeller shafts. In a further modification, each of the two sets of turbines A, B, C, Fig. 7, drives a shaft





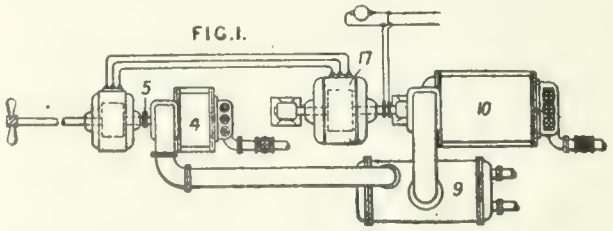
d through reduction gearing, while the cruising turbines E are geared to the shafts of the turbines C, thus driving the propeller shafts through a double reduction gearing. In a further modification, suitable for low-speed vessels with a single propeller, the whole of the turbines A, B, C, F, Fig. 11, drive the shaft *d* through double reduction gearing. Other modifications are described. Elements which are at times out of action may be provided with suitable clutches or may be made to run in the condenser vacuum.

25,899. Signalling Mechanism for Ships' Engines. An apparatus for signalling "ahead" and "astern" positions of marine-engine valve-gear, and for counting revolutions made in either position, as described in Specification No. 25,747, A.D. 1909, is provided with means by which the counters are actuated by parts having no mechanical connection therewith. The registering-mechanism comprises two counters 33, 34 and two glass signalling-tubes 27, 28. Each tube has a plunger 32 of aluminium fitting loosely so as to be able to rise with a slight air current, which is derived from a pulsator operated by the engine, with connections to the signalling-tubes controlled by the valve gear. Each plunger 32 has an extension 30, which, when raised, is adapted to strike a rubber button 37 on an arm 35 and to actuate the counter through a link 44 and a lever 43. The lever 35 when in its raised position, strikes a rubber pad 48 to accelerate the return movement of the parts. The tubes and plungers



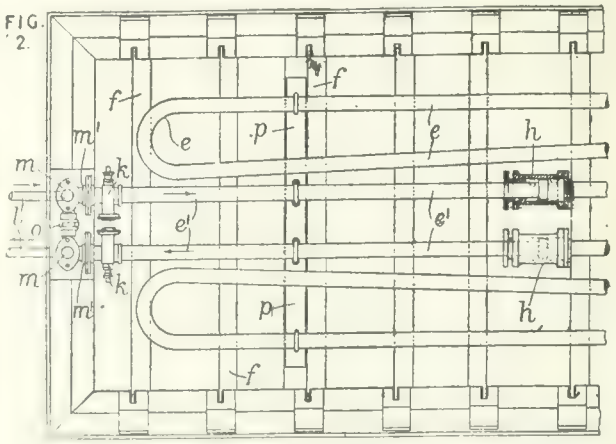
are also provided with rubber washers to act as cushions. Different-toned bells may be employed to give an audible signal.

26,346. Driving Gear for Screw Propellers.—Relates to the system of ship propulsion described in Specification No. 19,871, A.D. 1909, in which the propeller is driven in a forward direction by means of an electric motor 5 supplied with current from a generator 17 driven by a relatively high-speed turbine 10. According to the present invention, the propeller is driven in the reverse direction by a relatively



low-speed turbine 4 mounted directly on, or coupled-up to, the propeller shaft through gearing. Both turbines exhaust into the condenser 9. In a modification, the reversing-turbine is connected up to the propeller shaft by a combined coupling and speed-reducing device comprising a casing filled with water and containing driving and driven elements.

26,661. Ships. Relates to hatchways of ships' refrigerating holds or chambers, of the kind provided with a removable grid or grids of piping adapted to be connected to the refrigerating-pipes of the hold, etc. On the ends of the grid *e* are lengths of piping *e1* adapted to slide in cylinders *h*, which are provided with stuffing-boxes on their ends. The pipes



e1 are each provided with a valve *k*, and are adapted to be removably connected by flanges to branch pipes *m1* communicating through valves *m* with the permanent piping *l* of the hold. When the grid *e* is removed, the refrigerating-fluid is short-circuited through a pipe *o*, the valves *m* being of a three-way type. The grid is secured to carrier bars *p* and rests upon the usual removable beams *f*.

The Marine Engineer

And Naval Architect.

LONDON, MAY, 1911.

RESULTS OF TRIALS OF ANTI-ROLLING TANKS AT SEA.

AT the spring meetings of the Institution of Naval Architects last month an interesting paper on the results of trials of anti-rolling tanks at sea by Herr H. Frahm, was read, detailing the experiments carried out by this gentleman at the shipbuilding yard of Messrs. Blohm & Voss, of Hamburg, and on ships fitted with his device. The author opens his paper with the historical fact that the employment of free water in the hull for damping rolling motion was not new, as the old ironclad *Inflexible* had a parallel-sided athwartship chamber partly filled with water, and though the trials of these tanks in the Mediterranean proved their efficiency the trials were not repeated, owing to the impossibility of mastering the water rushing freely from side to side in the tank. Further the tank occupied valuable space which could be far better otherwise employed. The author's arrangement has been devised on the theory of resonance, by which bodies that can oscillate about a condition of equilibrium are made to swing severely under comparatively small impulses as soon as the period of oscillation of the impulse is synchronous with the individual periods of the respective bodies. It can be demonstrated that the phases of oscillation of the body and of the impulse are deferred by 90°. A ship constitutes a body of this kind, as she will oscillate under the impulse of the waves and will roll in her individual number of oscillations, even if the impulse be more or less irregular. Large heeling amplitudes can only be produced on a ship if she is struck by a series of comparatively regular waves, and struck in the measure of her individual number of oscillations. Under such circumstances the influence of resonance will be promptly felt, and there will be an increase of the angle of heel from wave to wave. The author's device has been based on this fact, as it uses a secondary and artificial resonance in order to annihilate the influence of primary resonance between waves and ship. This effect is produced by means of a U-shaped tank located athwartship, and extending from side to side, in which a water column can oscillate with the same number of swings per minute that are peculiar to the ship herself. The tank consists of three parts, the vertical portions at the two sides and the connecting portion; the water fills the latter completely and the former about half-way up. The dimensioning of the tank determines the period of oscillation and must be carefully calculated. As the phases of the impulse of waves and ship are deferred by 90° the ship lays a quarter of her full period behind the wave, or, in other words, the ship arrives at the heeling climax a quarter of a period later than the wave, in its advancing movement, arrives at its maximum slope towards the ship. The same law applies to the rolling of the ship, and the oscillating movement of the tank-water produced by the former, so that the tank-water will reach its highest or lowest level in the vertical parts of the tank a quarter of a period later than the greatest heeling of the ship to one side or the other. The result is that there is a total difference of 180° between the impulse of the waves and the oscillations of the tank-water, and the effect of one is in the opposite direction to the other and thus they neutralize one another. As illustrating the practical result of the theory, tanks have been fitted to two steamers of 14,000 tons loaded displacement, 447 ft. length and 55 ft. beam, and some interesting effects were obtained with the tanks in and out of action. Each ship has two sets of tanks, one fore and one aft, placed at the mast positions between the existing loading hatches on the uppermost deck, and each set consists of two tanks, 9 ft. high, 10 ft. athwartship breadth, and a length of 25 ft., the two tanks being connected by a connecting portion, 1 ft. 6 in. high, carried over the deck. Air connections provided with valves are arranged for throttling or entirely cutting off the connection, which will regulate or stop the motion of the tank-water. The total weight of water in each tank is 94 tons, and the turning movement exerted by all the tanks in full action is 2,790 ft. tons. In the trials on one occasion a heeling angle of 11° on both sides with an undamped ship was reduced to from 2° to $2\frac{1}{2}$°, and on another occasion an estimated heeling angle of 25° was reduced to an average heeling angle of from 4° to 5°. It will be conceded the results are very promising, particularly in view of the markedly favourable effect on the health of the passengers reported, and of the fact that these ships, which had previously been unsteady and much given to rolling, had become, through the addition of the tanks, quiet, comfortable vessels. We congratulate Herr Frahm on his able treatment of a subject that has laid dormant since the *Inflexible* experiment, and on the result which his thorough investigation of the subject has enabled him to carry out with predetermined accuracy.

THE PROBLEM OF SIZE OF BATTLESHIPS.

THE interesting subject of the size of battleships was dealt with at the same session in a paper contributed by Professor J. J. Welch, a past member of the Admiralty staff. The aim of the paper was not so much to deal with the arguments for or against increase of size, but to set out the factors which must be dealt with before a decision can be made. A further point of interest dealt with

was the extent, increase of size renders possible the carrying out of a larger big-gun installation whilst retaining unchanged the other characteristics of the vessel. The necessity for good broadside fire has been emphasised by tacticians in recent years, and the increase in the ratio of weight of broadside fire to displacement, as shown in recent ships, depends on the increased number of guns installed, the increase of calibre and the method of central mounting enabling all weapons to be used on either broadside.

A further point to remember is that guns can now be fired more rapidly, so that weight of broadside fire does not completely form a correct comparative feature as regards earlier vessels. An extremely interesting table accompanies the paper, showing that British battleships have increased 60 per cent. in displacement and 35 per cent. in length; the speed has been increased by over two knots, whilst the weight of metal discharged per broadside has risen from 4,000lbs. to 12,000lbs., an increase of over 200 per cent. In the U.S. Navy the displacement has more than doubled within the last ten years, the speed has been increased 3 knots, and the weight of metal thrown has increased 225 per cent. During the same period the German Navy has doubled the displacement of the battleship and the weight of metal thrown has increased 260 per cent. The author gives as reasons for and order of this development as follows:—As a result of the increasing radius of action of the torpedo and of the great increase in accuracy of gun-fire, due to improved training of gunners and increased efficiency of apparatus, it was realized that future naval battles would be fought at much greater ranges than obtained in the past, and that under such circumstances the projectiles from smaller guns than 12-inch would be relatively inefficient against armour. To make up in the newer vessels for the lighter gun hitherto carried more 12-inch guns were installed than the usual four. This involved increase of size, particularly as to length and additional beam, to give requisite stability for increased top weight. The increase of length was favourable to an advance in speed without undue increase of machinery weight, which feature has been materially assisted by the introduction of the steam turbine. The question of size must naturally be settled in relation to the advance of invention and manufacture, as more can be got out of a given weight of material to-day, either in guns, armour, machinery or in the provision of structural strength, than was formerly possible; hence these factors tend to decrease the size of the ship for stated acquirements or permit distinct advances in speed, protection and other features with much more moderate increase of dimension than hitherto possible. A controlling factor as to size is of course available dock accommodation and also dock alterations are expensive work. It is thought that the cost will not stand in the way permanently as a bar to maintaining our existing size as the largest possible. The author deals with an important practical point as to the number of vessels requisite to adequately perform the duties of the Navy, in home waters and abroad, in peace and war. A nation's resources are not inexhaustible, and some limitation must be put on cost, and hence on the size and powers, of individual ships; and while Parliament will doubtless vote the necessary money as deemed desirable by responsible authorities it is incumbent to get the maximum return for a given expenditure. The author has examined closely the question of the effect of increase of size of vessel on the number of guns which can be installed whilst retaining unaltered the type of gun, speed of ship, thickness of armour, and other factors, and has taken the particulars of a number of Japanese battleships built some years ago. The deductions made by the author are of a most interesting character, but the matter is too lengthy to be dealt with in these notes. The question of size of target from the aspect of attack from above owing to the advance made in dirigibles and aeroplanes of late years is the concluding point in the paper. The suggestion is made as to an attack being made from a height of one mile, and thus out of range of high-angle fire. If a hollow bomb carrying 100lbs. of explosive takes twenty seconds to reach water level it would have a striking velocity approaching 500ft. per second, while an under-water torpedo would take eighty seconds to do the same distance. In twenty seconds a ship proceeding at sixteen knots would move some 540ft., and the probability of such a vessel being struck from above would be reduced if at the moment of discharge of the bomb the helm were put hard over, although the time would not be sufficient for the vessel to sweep clear of her previous track before the missile reached water level, but the exposed area of deck in such track would be much reduced. This deals with the point of only one missile being dropped at a time, but as it is proposed to drop a number it must be recognised that this form of attack becomes a serious menace. The main conclusions of the author are rather shown by inference than direct statement, but the effect on one's mind is that Professor Welch is in favour of the all-big-gun ship of the present.

IRON AND STEEL INSTITUTE.—The annual meeting of the Institute will be held, by kind permission, at the Institution of Civil Engineers, Great George Street, Westminster, on Thursday and Friday, the 11th and 12th of May, 1911, commencing each day at 10.30 o'clock a.m. On May 11th the Bessemer Gold Medal for 1911 will be presented to Professor Henry Le Chatelier. The Andrew Carnegie Gold Medal for 1910 will be presented to Mr. Félix Robin (Paris), and the annual dinner will be held in the Connaught Rooms, Great Queen Street, W.C. A number of papers will be read and discussed during the meetings. The autumn meeting this year will, by the kind invitation of the Associazione fra gli Industriali Metallurgici Italiani, be held at Turin, and will commence on October 2nd, and, with the subsequent tour organized in connection therewith, will occupy about fifteen days.

THE INSTITUTION OF NAVAL ARCHITECTS.

THE Spring Meetings of the 52nd session of the Institution of Naval Architects were opened on the 5th of April, in the hall of the Royal Society of Arts in John Street, Adelphi. Sir William White presided over a very large attendance of members and visitors. The proceedings were opened by the president calling upon the secretary, Mr. R. W. Dana, to present the annual report.

Annual Report of the Council.

The council record their deep sense of the loss sustained by the death of the late president, Earl Cawdor. No one could have brought to the office higher qualifications for the task, or given proof of greater aptitude in the management of affairs. The admirable and sympathetic manner in which he had, during the brief time allotted to him, discharged the duties of president marked Lord Cawdor as one who, had he been spared, would have exercised a far-reaching influence upon the future of the Institution.

His Majesty the King, following the example of his august father, has been graciously pleased to become patron of the Institution, and to extend his patronage to the forthcoming jubilee celebrations.

The grant of a Royal charter of incorporation has received the Royal assent, and the Institution has now entered, as a corporate body, upon a new phase of its existence.

Owing to the lamented death of our late beloved Sovereign, King Edward VII., it was resolved to postpone until this year the celebration of the jubilee of the Institution. It is intended to mark the occasion by holding an International Congress in Naval Architecture and Marine Engineering in London on July 4 and the following days. It is a source of great satisfaction to the Council to announce that H.R.H. the Duke of Connaught has graciously consented to accept the honorary presidency of the International Congress, and to open the proceedings. Invitations have been sent to the Ministries of Marine Affairs of foreign Powers, and to the allied Institutions abroad, and it is hoped that the success of the meetings may not suffer through their unavoidable postponement.

The past year has witnessed a very satisfactory addition to the membership list, the number 161 of those elected at the spring meetings of 1910 being the highest yet recorded. The losses through death and resignation 72 have reduced the net gain in membership to 89. The membership of all classes totalled 1984 as against 1895, 1842 and 1796 respectively in the three preceding years. Among the candidates now coming up for election the Council are pleased to note the names of naval architects occupying important positions both at home and abroad, and a number of distinguished naval officers and prominent shipowners are also joining the Institution as associates.

The losses through death during the past year include among others, Earl Spencer, K.G., Hon. Vice-president; the Duke of Palmella (Portugal), Hon. Member; Vice-Admiral Sir Charles Campbell. Associate; Mr. James Riley, Associate Member of Council; and Engineer-Captain Philip Marrack.

Admiral of the Fleet, Sir Gerard Noel, K.C.M.G., etc., has been elected an Hon. Vice-Pres. of the Institution. The resignation of Sir Alexander Kennedy, F.R.S., etc., from the Council has been received with much regret.

The Council report the completion of the National Experimental Tank, and place on record once more their sense of obligation to Mr. A. F. Yarrow for his munificence in endowing the country with this valuable aid to the solution of problems in propulsion and resistance. The thanks of the Council are also tended to the subscribers whose liberality has created a guarantee fund which will provide for a considerable part of the annual cost of working and maintaining the tank; but further subscriptions are desired.

The Elgar scholarship in naval architecture, offered for competition last year, has been awarded to Mr. F. C. Cocks, of Chatham Dockyard, who is following the course of study at the Armstrong College, Newcastle-on-Tyne. The award of the annual premium has been made to Mr. T. B. Abell, R.C.N.C., for his paper on "Model Screw Propeller Experiments," read at the Spring Meetings of 1910.

It was announced that the Marquis of Bristol had been appointed to the presidency, rendered vacant by the death of Earl Cawdor, and the other elections to the list of officers included Admiral Sir Gerard Noel as Hon. Vice-Pres.; Members of Council, Mr. S. H. Barnaby, Mr. T. Bell, Mr. R. J. Butler, Mr. H. E. Deadman, Mr. J. J. Dunlop, Mr. Wm. Fife, Mr. John Gravell, Mr. J. Foster King, and Mr. C. C. Scott. Associate Members of Council—Admiral G. C. P. Fitzgerald, Vice-Admiral Sir J. R. Jellicoe, and Admiral Sir A. K. Wilson.

Presidential Address.

Sir Wm. White, in a short address, announced that the Council had unanimously recommended that the Marquis of Bristol should be elected President of the Institution, to fill the vacancy caused by the lamented death of Earl Cawdor. Lord Bristol had been communicated with, and had expressed his willingness to take office. The late Earl Cawdor was the first president of the Institution who had died in harness. It was a remarkable fact that the Institution had had but six presidents in the 50 years of its existence. Lord Hampton, the first president, held the office for more than 30 years, and was followed by Lord Ravensworth. Afterwards came Lord Brassey and the Marquis of Linlithgow, followed by the Earl of Glasgow. On behalf of the Council he desired to tender to Lord Brassey and Lord Glasgow their sincere thanks for the help they had rendered in the troubles arising through the death of Earl Cawdor. The Council had the greatest satisfaction in nominating for the presidency a nobleman who would certainly prove a worthy successor. The Marquis of Bristol had had a brilliant career as a naval officer, and was still on the active list. In the House of Commons and elsewhere he had given many proofs of ability and fairness in the discussion of naval subjects. He was an admirable representative of one of the most important sections of the Institution's membership, namely, of the naval officers whose names appeared on the list as associates. The Council felt that their choice had been a wise one, and that the Institution would be greatly benefited by the services which Lord Bristol would render. In recent years the marked developments in auxiliary machinery on board ship had given ground for the consideration whether a still more liberal interpretation might not be given to the phrase marine engineer. That was a subject to which the Council were giving close attention, and recommendations would be placed before the Institution in due course if any were found desirable. So far as membership were concerned, there was room for considerable increase in the associate class; they did not draw sufficiently from that very considerable body of men, *viz.*: those interested in shipping and marine engineering. The programme of papers to be read showed that there was no falling off in the variety or interest of the subjects for discussion.

The Chairman referring to the paper on the present position of the National Experimental Tank, reminded the meeting that only £1,500 out of the £2,000 maintenance fund had yet been subscribed, and he hoped that the balance would soon be found.

After the presentation of the Institution Premium to Mr. T. B. Abell, the papers were taken. The first paper on the agenda was "The problem of size in battleships," by Prof. J. J. Welch, which forms the subject of Editorial comment in this issue. The paper on the geared turbines of the "Vespasian" we print *in extenso*. The second day opened with Mr. J. T. Milton's paper on "Diesel engines for sea-going vessels," the first portion of which will be found elsewhere in this journal. Other papers read on this date were "The influence of longitudinal distribution of weight on the bending moments of ships among waves," by Mr. F. H. Alexander; "Considerations affecting local strength calculations of ships," by Mr. J. Montgomerie. In the evening:—"The acceleration in front of a propeller," by Dr. Froude; and "An investigation into the stresses in a screw propeller," by Eng.-Lieut. A. Turner.

On the third and last day, Dr. H. Frahm's paper on "Results of trials of the anti-rolling tanks at sea," was taken, which we deal with elsewhere. The other papers were: "Steering gear experiments on the turbine yacht

Albion," by Messrs. Hele-Shaw and F. Leigh Martineau; "Description of a stability and trim calculator," by Mr. Ralston; "General propositions and diagrams relating to the balancing of the four-cylinder marine engine," by Mr. C. E. Inglis; "The determination by photo-elastic methods of the distribution of stress in ships' plating," by Prof. E. G. Coker; and "Some notes on a new design of merchant vessel," by Mr. Ballard. We hope to deal with some of these papers in a future issue of *The Marine Engineer and Naval Architect.*

JUBILEE MEETINGS, 1911.

The preliminary programme arranged for the International Congress in Naval Architecture and Marine Engineering is as follows:—On July 3rd, in the evening, a reception will be held at the Royal United Service Institution. H.R.H. the Duke of Connaught will formally open the Congress on the 4th at 11.30 a.m. in the Connaught Rooms, Great Queen Street, near Kingsway. This will be followed by an official visit to the Coronation Exhibition in the afternoon, and the Right Hon. Lord Brassey, G.C.B., Past Pres. of the Institution, will give a reception in the evening. Visits will be paid to the Empire Festival at the Crystal Palace, on the 5th, the National Physical Laboratory on the 6th, and a trip down the Thames will be taken on the 7th to visit the docks and shipping of the Port of London. The banquet to the delegates and representatives will be given at the Connaught Rooms on the evening of the 6th July. Papers will be read and discussed in the halls of the Institution of Civil Engineers and Institution of Mechanical Engineers on July 5th, 6th and 7th, and will include papers contributed by Admiral Sir Cyprian Bridge, G.C.B., Sir Andrew Noble, K.C.B., Sir William H. White, K.C.B., Sir Philip Watts, K.C.B., Hon. C. A. Parsons, C.B., Mr. S. W. Barnaby, Mr. S. J. P. Thearle, D.Sc., Mr. C. E. Ellis, Colonel G. Russo (Italy), Admiral Kondo, I.J.N., Mr. Uchida, Count Shiba, Prof. Terano (Japan), Dr. O. Schlick, Prof. Flamm (Germany), Prof. A. Rateau (France) and Mr. J. Johnson (Sweden).

THE PROTECTION OF PROPELLER SHAFTS.

THE corrosion which occurs in unprotected propeller shafts in the stern tube between the brass bearing liners, shortens the life of the shaft considerably, and brings it to the scrap heap before its legitimate term of life, a term which might otherwise be almost coincident with the life of the ship itself. Even with reduction of margin due to corrosion we have seen shafts, after running steadily for eight to nine years, still equal to their work. In many cases the margin given by the engine builders is about 5 % to 10 % over the Board of Trade rule, to allow for depreciation, and in such cases the owner has the advantage with the higher margin, due to a reduction in the average running costs over a number of years. We have noted steamers which have had spare propeller shafts fitted after six years' service, and not a few which have suffered loss by breakage at sea.

Many arguments have been advanced to trace and fix the cause of the corrosion which is always more or less active on the unprotected shaft between the liners; some have been based on galvanic or magnetic, others on electrolytic action (especially in the cases of single-wired ships). Obviously, without much argument, unprotected iron or steel exposed to the influence of sea-water will corrode, and in the case of a revolving shaft with intervals of rest, the corrosive action will be aggravated. It may be remarked that phenomenal cases have been observed where the magnetic influence on the face of a shaft coupling, after being disconnected, has been considerable, and an arrangement was made and tested some twenty years ago to counteract this influence as detrimental to the life of the shaft. The practice, now frequently carried out, of lining the shaft with brass throughout the stern tube to the propeller boss outside, and to well beyond the gland inside the tunnel, is one which affords protection to the shaft and has been found efficient and effective on the whole, although instances have occurred to show that it is desirable to know what is going on underneath the lining and to see the shaft itself at stated periods, especially where the liner is not in one continuous length; the places requiring careful testing being at the junctions of the different diameters or of the liners. Seldom is it that, due to the porosity of the brass or the brazing, the water finds its way in between the shaft and the liner, involving cutting away the latter to expose the shaft for inspection; still, cases have occurred. The rubber sleeve in lieu of the brass has been tried and found favour in a few steamers, as being less costly and lending itself more readily to removal for inspection of the shaft and readjustment. The method of preserving the shaft by running it in a bath of oil has been in use for many years in a good number of steamers in one form or another, and has been advocated for more extended service by those who have had good experience of it.

A common plan—perhaps by reason of its handiness—of preserving the exposed part of a shaft is by means of marlin or wire lapped round it, then coated with bitumastic solution. This has its objections, as in the event of the lapping being nipped in replacing or becoming loose, the re-drawing of the shaft would be attended with considerable difficulty. Another arrangement, recently tried and adopted for old as well as new shafts, has been brought to our notice. It is in effect similar to the last-mentioned, but a considerable improvement upon it, having the advantage of ready application and removal, while forming an efficient protection, with very little risk of becoming impaired or loose. It is a specially-prepared tape upon a thoroughly elastic adhesive solution, which is non-corrosive, water and acid-proof. One ply of tape is firmly wrapped on the shaft, on this a coat of solution is placed and another lapping is wound, and when completed the surface is uniform, smooth and quite water-tight. When necessary to expose the shaft for official inspection the covering can be readily removed and as readily replaced (where disturbed) with the shaft in the tunnel. The process is less costly than that of covering the shaft with brass, it appears to be effective and its adaptability gives it a certain advantage. We note that there are firms at the chief seaports who undertake the covering of shafts, acting under the direction of the manufacturers. The shafts of the following named steamers, among others, have been covered:—*The Peregrine, Kingfisher, Atlantian, Kelvinside, Flawyl, Kaiser Wilhelm der Grosse, Hildebrandt, Great Southern, etc.* This shaft covering is being manufactured and introduced by The Continental Tyre and Rubber Co. (Great Britain) Ltd., of Thurloe Place, South Kensington, London, S.W., and Willesden, N.W.

THE "COMET" TELESCOPIC MAST AND HOIST.

MANY efforts have been made in the past to devise a portable apparatus which can be expanded to a considerable height and when so expanded have a fair amount of stiffness and resistance to bending moments. The uses to which such devices can be put are almost too numerous to mention, but there are many directions in which they can be applied in shipyards and repairing docks.

We have pleasure in illustrating and describing what appears to us an eminently practicable apparatus, the merits of which when appreciated should serve to win an extensive use. In the adjoining illustrations Fig. 1 represents a mast in its collapsed condition. We

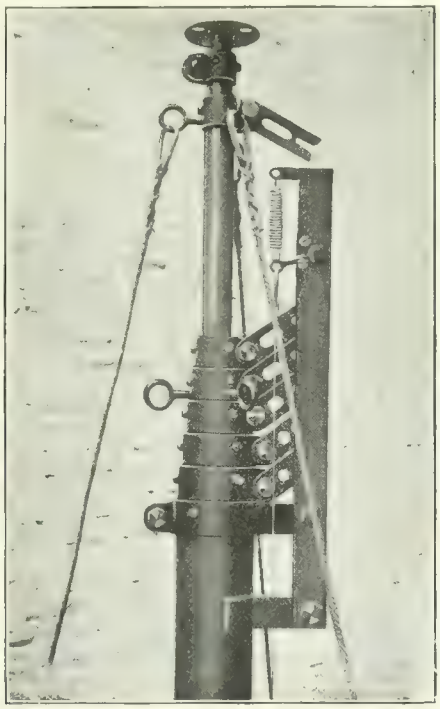


Fig. 1.

understand that the mast has been approved by a number of foreign governments for Wireless Telegraphy, Searchlight and Observation work, and there seems little doubt that it may be successfully adapted for use in a number of appliances on board ship. The application of the principle is by no means confined to masts of light construction, and there is no reason why fighting masts on this principle should not be employed instead of the stationary mast. The utility of a mast which raised or lowered from the deck, would permit firing instructions, signalling, wireless telegraphy, etc., to be carried on as and when required is a matter well worthy of consideration. Masts carrying searchlights could be raised or lowered to a position of safety during action, and the principle has already been applied with success to signalling masts for naval purposes, as well as for wireless masts for submarines. The mast is used in building and constructional work as a substitute for scaffolding, consequently there is no reason why it should not serve a similar purpose in the ship-building yard. The device consists of a series of welded steel tubes of

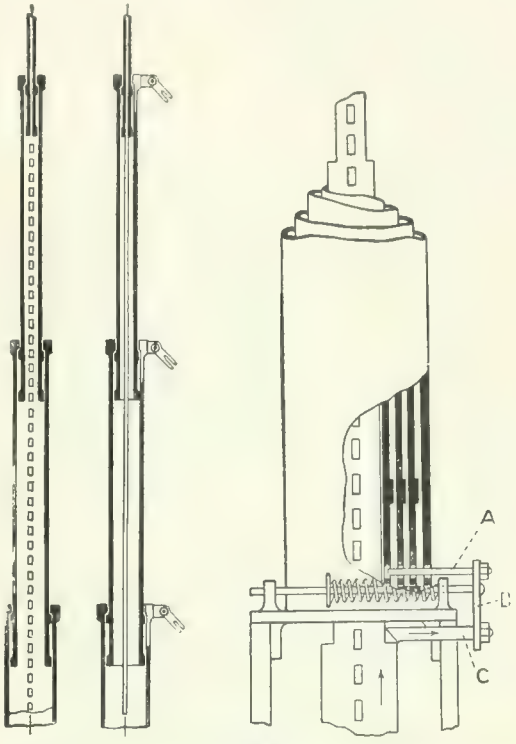


Fig. 2

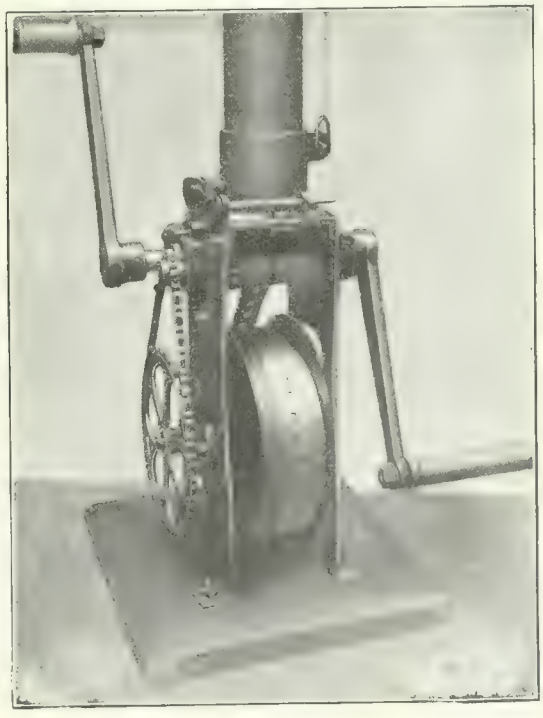


Fig. 3

gradually decreasing diameter and thickness which are adapted to slide telescopically within one another. Each of the tubular sections has affixed to it three

collars, one at the top and two at the bottom end. The top and bottom collars serve to strengthen the end of the tube, while the intermediate collar acts as a stop in conjunction with the top collar of the immediately preceding section to avoid the sections being drawn out of one another.

The hoisting mechanism is illustrated in Figs.

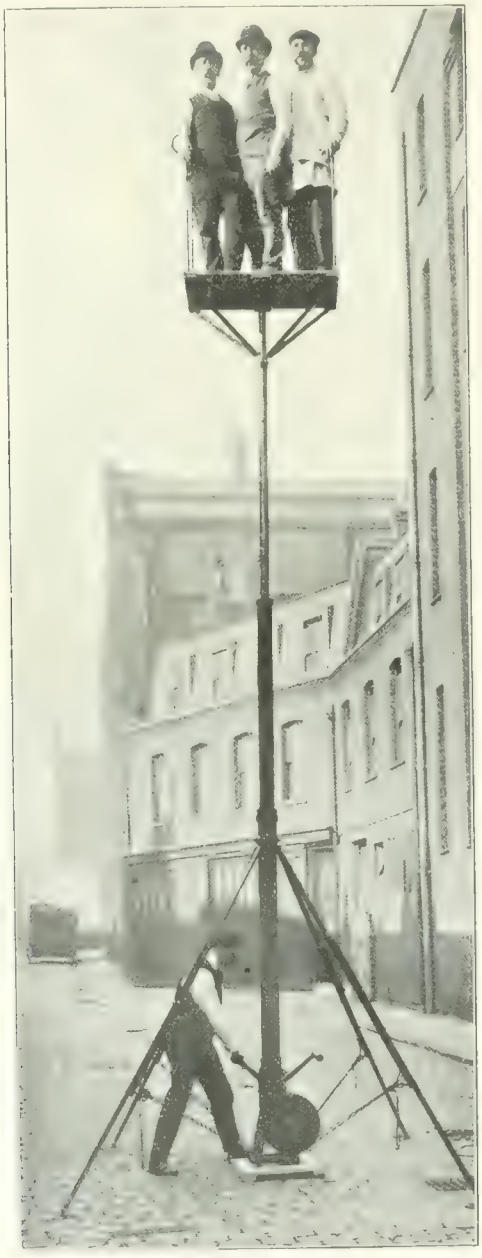


FIG. 4.

2 and 3 and consists of a drum rotatably mounted in the pedestal of the mast and is chain-driven from a crank handle. Round the drum a perforated untempered steel band is coiled, the end of which on leaving the drum passes up between two rollers, one of which is provided with teeth to fit the perforations of the band. It will be seen from Fig. 3 that the rollers and drum are driven simultaneously by means of the handle. The band is of various widths along its length and follows the internal diameter of the tubes in which it is placed, so that it has a stepped formation as shown in Fig. 2. Within each section the band is a sliding fit and occupies the full diameter of the circular tube or the diagonal of a square sectioned tube so that the band thus restrained by the walls of the tube acts as a rigid member to thrust or push its load upwards. When the handle is turned the band is both paid out from the drum and forced to ascend within the tubes, carrying with it section after section as each section becomes fully extended, the abutting collars on the section causing the following movement of one section after the other. It is necessary, however, that as each section becomes extended telescopically it should be locked to the adjoining section and further that the sections shall only rise in their proper order and descend in their reverse order. By reference to Fig. 2 it will be seen when all the sections are down holes drilled in the side of the sections register with one another enabling a retaining bolt *a* to pass through the holes. The bolt *a* is attached to a crosshead *b*, which is spring pressed inwardly and carries at its lower side a tripping bar *c*, having a bevelled end so as to engage with the shoulders of the steel band. Just before the complete extension of any section the shoulder on the succeeding portion of the band pushes the bar out a certain distance and thus frees the next section of the mast. The locking device is fixed to the top of the tube, which is provided with a vertical saw cut and in conjunction with this cut each top collar acts as a clamp, so that when the closing of the saw cut takes place the play between the sections is taken up and the whole mast becomes rigid. The operation of these clamps is quite automatic, both on extension and on collapsing, and is effected by means of a forked lever fitted to each section for operating its particular clamp. The fork of the lever engages with a fixed bracket, which turns the lever about its axis. When the clamp is open the lever is pointing upwards and when closed downwards, and as soon as one section is completely raised and the next is about to rise the forked lever engages a pin on the fixed bracket, so that the section in its movement turns the lever downwards and locks the section in position. It is obvious that on the reverse motion the reverse action takes place.

As illustrating what a device of this character is capable of, in Fig. 4, the mast is shown in its extended condition with a platform at the head carrying three men. As example we may quote figures which have been furnished to us relative to a round mast which, when extended, is 84 feet in height; this when closed, is 11½ feet long, of which 1¼ feet are occupied by the hoisting mechanism. The approximate weight is 307 pounds, so that it can be easily handled by two men. It is composed of 10 sections, the greatest diameter being 4½ inches and the smallest diameter 1¼ inches, and is capable of bearing a vertical load of 265 pounds, and can be extended to the full height in 30 seconds. The device is being placed on the market by the Comet Telescopic Mast Co., of 20, Bucklersbury, London, E.C.

THE G.M. BALANCE OR STABILITY INDICATOR.—It is of interest to note that a G.M. Balance or Stability Indicator has been designed for the s.s. *Indrabarah*, and recently delivered to the order of Messrs. Swan, Hunter & Wigham Richardson, Ltd.

Speed in knots	9·31	9·00	9·94	10·34
Revolutions per minute ..	68·4	71·2	73·7	77·0
Boiler pressure, lbs. ..	130	142	146	141
H.P. Turbine, initial pressure	76	86	96	109
Vacuum (in inches) ..	28·8	28·6	28·55	28·4
Barometer	30·2	30·2	30·2	30·2
Water consumption, main engines, lbs. per hour ..	10 400	11 510	12,590	14 000
Shaft Horse-Power ..	630	720	815	945
Water consumption, lbs per S.H.P. hour ..	16·5	15·98	15·45	14·81

Diagram 1.

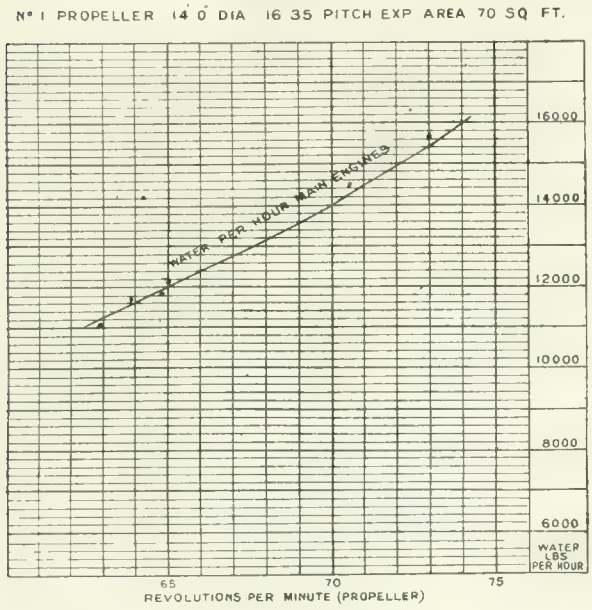
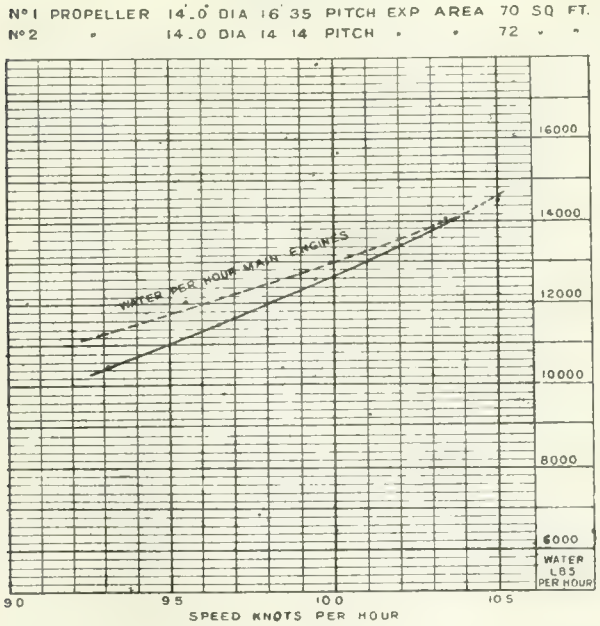


Diagram 2.



The water consumption for the several rates of speed have been plotted on Diagram 2, shown in full lines for the new propeller and in dotted lines for the original propeller. Diagram 3 shows the revolutions obtained at the several rates of speed for each propeller, and Diagram 4 the shaft horse-power in terms of water consumption per hour. The full lines in each case are for the new propeller and the dotted lines for the original propeller.

It will be noted that at the speed of 9·3 knots, which is about the average service speed of the vessel, the water consumption per hour has been further reduced with the new propeller by about seven per cent., four per cent. being attributable to the increased efficiency of the turbines running at the higher revolutions, and the remaining three per cent. due to a slightly more efficient propeller.

In regard to the question of economy generally, as mentioned in the reply to the discussion on last year's paper, we do not profess that the results obtained with the *Vespasian* are the highest obtainable with geared turbines. In a new vessel, and with new boilers, say, of about 180 lbs. pressure, a consumption of about 12½ to 13 lbs. per shaft horse-power

Diagram 3.

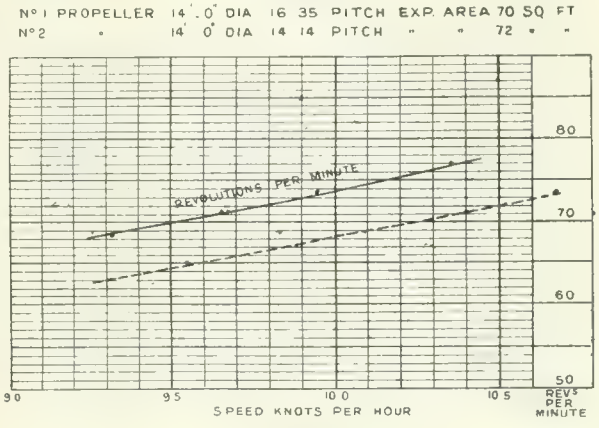
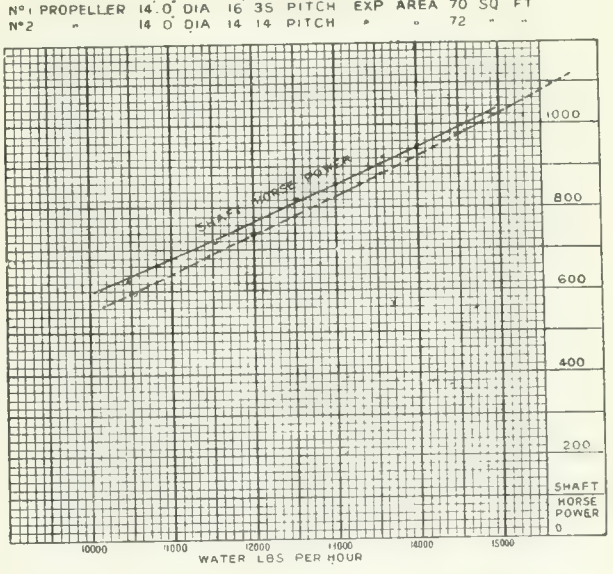


Diagram 4.



of the main engines, as compared with 16 lbs. at the service speed of the *Vespasian*, could confidently be expected in an installation of, say, 1,000 H.P., which would be equivalent to 11½ to 12 lbs. per indicated horse-power of reciprocating engines, assuming a ratio of shaft horse-power to indicated horse-power of 91 to 92 per cent.

In conclusion, it may be mentioned that the introduction of gearing into war vessels presents great advantages, since its adoption would result in increased economy, more especially at cruising speeds.

In a large war vessel, say, having four shafts, the gearing of the highest pressure portion of the turbine to the low-pressure shafts in lieu of direct-coupled cruising turbines, effects a saving in consumption of fully 25 per cent., at a cruising speed equal to one-tenth of the full power, and 30 per cent. at one-fifteenth of the full power, giving corresponding increases in the cruising radius with the same quantity of coal.

ELECTRO-HYDRAULIC STEERING GEAR.

Messrs. John Hastie & Co., Kilblain Engine Works, Greenock, who are to fit steam steering gear in the large Orient liner *Orama*, at present on the stocks of Messrs. John Brown & Co., Ltd., Clydebank, will also supply to that vessel an auxiliary or alternative steering gear of a type as yet quite new to ships of the mercantile or naval marine, but which—in a more or less experimental form—has for over a year past been in use on board the *Albion*, one of the largest British steam yachts, 240 ft. long, B.P., 37 ft. beam, 16 ft. 6 in. draught, and 1,700 tons displacement. This is the Hele-Shaw-Martineau patent electric-hydraulic gear, the invention of Dr. H. S. Hele-Shaw, F.R.S., and Mr. F. Leigh Martineau, who, in a paper read before the Institution of Naval Architects, gave the working results of the gear fitted on the *Albion*. Built in 1905 by Messrs. Swan, Hunter & Wigham Richardson, Wallsend, the *Albion* was fitted with electric steering gear, but in 1908 this was replaced by steam steering gear of Messrs. Hastie & Co.'s make. Early last year the Greenock firm fitted to the *Albion* the auxiliary or alternative electric-hydraulic gear under notice. It has practically been in operation ever since its installation; and the two systems of gear being worked from the bridge through the same steering wheel and telemotor—either being used as desired—a decided preference has been shown by the captain and quartermasters for the new gear. Briefly stated, the electric-hydraulic gear consists of two hydraulic rams working in cylinders on each side of the rudder-stock actuating the usual cross head. The rams are actuated by oil supplied under pressure from a rotary variable stroke pump driven by an electric motor alongside, the pump referred to being a very essential part of the arrangement; as it solves the difficulty hitherto met with in employing electricity for steering gears. It is of high efficiency for a large range of pressures, can work at high speed, and can thus be coupled direct to the electric motor. The pump is controlled by rod and lever connection, both to rudder-stock and to the receiver of the telemotor, which is actuated from the navigating bridge. If the rudder-head is overstressed in any way, means are provided, by transferring oil from one cylinder to the other, to make the rudderhead yield to the shock, the pumps being automatically set in operation, and the rudder restored to position. The new steering gear can be installed as an alternative, without in any way interfering with the efficiency of the ordinary gear; and it is understood the new gear on the Orient liner will at first be chiefly used as a substitute for the ordinary gear, where navigation is not difficult, such as on long ocean runs. The makers and patentees are understood to have guaranteed that, used in this way, a very substantial reduction of coal consumption will take place on a voyage to and from the Antipodes. Messrs. Hastie & Co. have on hand, besides this gear for the Orient liner, orders for two additional gears for the Austrian-Lloyd steamers, *Wein* and *Helouan*, being built on the Continent, as well as for several other large vessels.

REFRIGERATING APPARATUS FOR MARINE TRANSPORT.—The series of articles will be continued in our June issue.

NEW GRAVING DOCK AT BELFAST.

THE new graving dock, which is the largest of its kind in the world, was informally opened on the 1st April, and it was singularly appropriate that the first vessel to enter it should be the largest in the world, the White Star Liner *Olympic*. The new dock is 887 feet long, with a width at entrance of 96 feet, and 35·3 feet depth of water on the sill at high water, ordinary spring tides. It can be filled in 60 minutes and pumped dry in 100 minutes, the quantity of water dealt with being about 23,000,000 gallons. Notwithstanding its size, after seeing the *Olympic* in the new dock, one is forced to the conclusion that it is not a bit too big, in fact, that it is not large enough, and this is significant of the ever-increasing size of the Atlantic liners. It may be said that the *Olympic* completely fills the dock, and that no vessel appreciably bigger could enter it, and already there are larger vessels than the big White Star boats building. Lord Pirrie, speaking at the luncheon after the docking of the liner, said that before long the requirements of shipbuilders would necessitate the provision of even larger docks. The cost of the new dock, including collaterals, such as pumping machinery, hydraulic plant, etc., amounts to £316,325. It has been constructed under the supervision of Mr. W. Redfern Kelly, M.I.C.E., and the contractors were Messrs. Walter Scott & Middleton, of London. The dock will not be formally opened until June.

GAS-COAL AND OIL-ENGINED VESSELS.

THE announcements made during April have included orders for large Diesel engines to be fitted in vessels of considerable tonnage. The Anglo-Saxon Co. having, it is said, decided to build another vessel of 4,000 tons displacement with Diesel engines of about 1,000 horse-power, it may be granted that the results of their first vessel, the *Vulcanus*—whose visit to the Thames has been looked for expectantly—have been accepted as satisfactory, and the 9,000-ton vessel reported as ordered by a Belgian Company to be fitted with twin-screws driven by Diesel engines, each of about 1,000 horse-power, shows a further advance of confidence in this type of driving power. The engines are to be constructed by the Amsterdam firm, four-cycle with six cranks, designed for about 140 to 150 revolutions.

There are other vessels also on the eve of being built or being fitted with oil engines, one for the carriage of oil of 5,000 or 6,000 tons to be fitted with Diesel engines, others of the auxiliary power class for which the gas engine is specially suited, and the sailing ships, whose days seemed to be numbered, may now have a new lease of life, and on the Continent we have recently seen indications of a movement being made to adopt this class of motive power as an auxiliary to sails for sea-going vessels of large tonnage. There are also enquiries and orders being placed for barges to be driven by oil engines, both for canal and river traffic. The order from Messrs. Cadbury for two steel barges of about 70 ft. long given through Messrs. Pollock & Son, Ltd., is one of those noted to be fitted with the Bolinder's reversible oil engine.

The report of Captain McEwan to the Fishery Board of Scotland, based upon the Exhibition held at Yarmouth last autumn, is very interesting, dealing as it does with the various styles of oil engines and boats which were on view and under test, and we commend a perusal of the report to those who are considering the subject of fishing-boats and craft for coastal or river service. The paraffin engines of 45 to 60 B.H.P., approximately fitted complete and costing from £540 to £590, are stated to have a running cost for 100 hours of from about £11 5s. to £12 10s. 6d., or from ·487d. to ·6d. per B.H.P. per hour, assuming the price of paraffin

to be 6d. per gallon; while the crude oil engines of 40 to 80 B.H.P., fitted complete, costing from £500 to £680, have a running cost of about £3 0s. 5d. to £8 1s. 8d. per 100 hours, or from ·175d. to ·25d. per B.H.P. per hour, with crude oil at 2½d. per gallon and paraffin at 6d. A comparison is made in the running cost of steam with coal at 20/- per ton, crude oil and paraffin, which comes out on an average respectively at ·214d., ·202d. and ·54d. per B.H.P. per hour. This shows only a slight advantage over steam in favour of the crude oil engine, indeed, experimental research recently has seemed to place steam, when used in its most economical way, in a position ahead of gas for economy. To these averages, however, the other costs of steam boiler, attendants and depreciation have to be added, with bunker space and weight of coal as a consideration against steam power, thus leaving the balance more in favour of the oil. The word of warning we gave last month as to the class of attendant is taken up by Captain McEwan, who points out in his report that the tendency is to leave the machinery to its fate when all hands are called to close duty in connection with deck or cargo work, with corresponding detriment to the engine and its connections. Like every class of machinery, all the care and attention, with experience of the details, bestowed upon it on the part of the man in charge pays in the interests of the mechanism entrusted to him. An object lesson is cited in respect to this in the case of the motor-drifter *William Beardmore*, which did well during its early months of running while in charge of a competent and experienced man from the builders, but subsequently came to grief when entrusted to the care of a member of the crew. For coastal work and fishing-boats the gas engine has advantages over steam, yet there are disadvantages in that the cargo and deck work have to be provided for by steam, compressed air or other means. The races which were held at Monaco did not result in good awards to British boats, as these were carried off by others, chiefly owing to the mishaps which overtook the fastest boats; thus the *Maple Leaf*, whose propeller failed at a critical time, *Miranda* and *Ursula*, who also came to grief, would probably have turned the scores in their favour against their competitors had all gone well with them. In their trials at the races these boats gave a speed at the rate of 45 to 50 miles per hour.

It would be interesting to know and study the data from the 400 B.H.P. Diesel engine which was fitted in the *Lady Evelyn*, now being refitted, the oil engine being replaced by the steam engine at Southampton. The economy over steam appears to have been considerable, but defects developed under marine service, which will be corrected from the experience gained; and probably another vessel will be built to be fitted with twin-screw oil engines improved upon from the experience gained. Water-jacketing and valve gear troubles tend to develop under sea-going conditions which, in land practice, would not occur, and marine engine builders, from their experience, should be in a position to guard against and make their designs accordingly, and it is attention to the small details founded upon experience which make or mar the whole. The yacht *Phantome* is well advanced in her fitting out at Gosport, and the oil engines which are being installed it is hoped will prove both efficient and reliable. The trials will be interesting and profitable to those who are looking forward expectantly, and Messrs. Camper & Nicholson will soon see the results of their handiwork now approaching completion. Messrs. Curtiss & Son, Portsmouth, have ordered a Beardmore oil engine for a small cargo vessel being built by Messrs. Vosper. Previous boats for this firm have been running with successful results; the repeat order is a consequence of this. Beardmore engines have also been fitted in the *Harkaway*, by Messrs. Crouchers, Isle of Wight. There are now several coasting vessels running in the neighbourhood of the Solent fitted with Beardmore engines and doing well; besides there are the pilot cutters *Solent* and *St. Helen*, also fitted with Beardmore engines. The sea-going barge, fitted with Diesel engines, of Swedish make, and installed by the builders on the north-east coast, has had satisfactory trials. It was expected that this vessel would proceed to Canada, but she is apparently being used for a series of trials, coasting to discover all the advantages and disadvantages of the details before she leaves for her ultimate destination. The new motor-boat for the Thames Mission, about 56 ft. long, built by Messrs. Cran, Leith, and engined by Messrs. Beardmore, has given satisfactory trial results, and *George Wishart the Martyr*—the name of the vessel—will be a welcome addition to the other motor-boats running on the Thames. From the plans she appears to be a handy and convenient boat for her purpose. The Motor Exhibition at Olympia was exceedingly interesting, the collection of aeroplanes was a great attraction, and the motor-boats on view were a delight to the eye, some of them exhibiting the highest art of the builder, while the motors and accessories on view showed the advances made to comply with the conditions of the market demand, whether for driving purposes or the comfort and convenience of prospective passengers, whether on sea, in air or on land.

The pilot service is being added to by oil-engined boats, and the advantages gained thereby are being more and more appreciated. A typical boat by Messrs. Thornycroft was recently run on the official trials and handed over to the authorities at Belfast. The idea of making use of a car-motor to drive a boat has been carried into practice for testing purposes or models, but a novel application has been proposed for touring parties. When it is necessary to cross water, a boat may be kept in readiness, fitted with a propeller, the shaft of which should carry a belt pulley; the touring car motor would be fitted with the driving pulley, ready to be coupled up on the car being transferred from the road to the water-borne vessel, the car thus becoming its own conductor across the loch, lake or arm of the sea. Whether the idea takes effect or not it shows imaginative thought brought to bear upon situations of difficulty and embarrassment.

THE ECONOMICS OF SHIP PROPULSION.

ON April 5th, Mr. Andrew Hamilton, M.I.C.E., M.I.N.A., read a paper entitled "The Economics of Ship Propulsion" at the Liverpool Engineering Society.

After dealing with the design of vessels in relation to speed, and the effect of wind resistance on deck erections, Mr. Hamilton went on to say that, generally speaking, the compound reciprocating engine held its own when capital account must be kept low, as in tug boats, etc. A few years ago, when the triple-expansion engine was introduced, many expected a far larger number of conversions from compound to triple than was the case, because the capital expenditure was not fully considered. The triple-expansion reciprocating engine was now having its position assailed, but the comparatively low initial cost kept it in favour for a large range of tonnage. With refinements in design many believed that it was nearly, if not quite, equal to the quadruple, with 215 lb. to 225 lb. working pressure, necessarily higher-class material, 8 per cent. to 10 per cent. increase in first cost, and 6 per cent. in machinery weight. Thus in triple machinery valued at £33,000, quadruple meant about £2,600 to £3,000 extra capital, and an annual expenditure in insurance, depreciation and interest of about £400 to £500, which had to be covered by coal economy, extra cargo carried, or time saved. With coal at 17s. per ton, the £500 was equivalent to 600 tons. With a coal consumption of 60 tons a day, as for the suggested £33,000 triple machinery, and 180 days steaming per annum, a saving of 3¼ tons per day was required, and this was not easy to get. The price of machinery to a good specification for 3,000 to 6,000 i.h.p. was:—Triple-expansion engines and boilers complete, about £7 per i.h.p.; weight per 100 i.h.p., 23 tons; quadruple-expansion engines and boilers complete, about £7 5s. per i.h.p.; weight per 100 i.h.p., 25 tons. There was also the combination, or mixed machinery, where three propeller shafts, with two triple reciprocating engines and one turbine were employed; but the ordinary cargo vessel was not likely to be troubled with this type of machinery. In such vessels the three shaft tunnels occupied valuable cargo space, and therefore raised the centre of gravity of cargo in the after holds; but with the faster cargo and passenger steamers there appeared a more suitable field. In a vessel, say, with 13,000 to 15,000 i.h.p., and machinery valued at £90,000, £7,000 had to be added for cost of turbine, together with about 2½ per cent. to weight of engine department. This £7,000 increase in capital meant £1,000 to £1,100 per annum to be covered by coal saving, or six to eight tons per day.

When the high and low-pressure Parsons turbines were considered as they were now usually fitted to three and four

shafts, it was found that the positions assigned to them were all for high-speed work. This want of ability to reduce speed while maintaining coal economy had been so great that some owners had considered the advisability of reverting to the reciprocating engine. The demand that the turbine must not only be mechanically, but also financially, successful was causing modifications in the direction of a combination of the impulse and reaction turbine, as in the new Parsons, the Curtis-Brown, Willans and the Brush machines. There appeared to be a possibility of a serviceable installation for twin-screw steamers for moderate to high-speed vessels being evolved with this combination. The largely increased number of makers of turbines, and the careful study of details and manufacture, were gradually reducing the cost, so that the ordinary shipowner might yet find them economically possible. At present the average cost of turbines in 20,000 i.h.p. machinery was about £6 per i.h.p.; the weight, approximately, per 100 i.h.p., was 14·5 tons.

It appeared that, except for special purposes and in the Navy, where cost was not so important, oil fuel under present conditions could be used in this country only to a moderate extent; or, when coal cost 18s. 6d., the price of oil must be under 32s. a ton. If, as stated, the proportion of oil available was limited, then its use must be restricted, and adopted only when the greatest efficiency could be obtained, as for superheating after steam had been generated in coal-fired boilers. With regard to oil engines, it had been recently proposed to fit a vessel with engines of 150 to 180 total h.p. Two engines at 200 r.p.m. would cost £2,200, which, with cost of foundations, oil tanks, two sets of propeller shafts, charges, etc., would be increased to £2,900. The annual charge at 15 per cent. on, say, £3,000, would be £450. Steam engines, compound, of similar power, single screw, one single-ended boiler, would cost £900, which, with foundations and charges, would be increased to £1,260. Fifteen per cent. on, say, £1,300 would be £195, showing a debit of £255 against oil on capital account. Taking the consumption of oil at 0·8 lb. per i.h.p hour, 150 h.p. would equal 120 lbs. per hour, which, at £1 15s. per ton. would amount to 1s. 10½d. per hour; and 180 days would cost £405. The cost of coal for 150 i.h.p., taking 3 lbs. per hour at 12s. a ton, would be about £518 for a similar period. Therefore the capital account and cost of fuel stood at £855 for oil, and at £713 for coal; but in the case of the former, credits on account of extra cargo capacity and less attention (£230) reduced the total to £625, or £88 below the corresponding figures for coal.

There were great possibilities with the use of producer gas engines. The *Rattler*, fitted with a five-cylinder single-acting engine, giving about 500 i.h.p. at 120 r.p.m., was about the largest yet fitted, and although this vessel did not fulfil all expectations, there was no doubt that many more vessels of moderate power would be fitted with producer gas engines. The total weight of producer plant complete was about 25 per cent. less than in the case of a steam installation, while the space occupied by bunkers and producer would be 30 and 50 per cent. less respectively. For a 400 to 500 i.h.p. engine and producer the weight was 17 to 19 tons per 100 i.h.p., and the cost about £8 5s. per h.p. The coal consumption was less than 1 lb. per i.h.p. The present difficulties were in connection with the handling of the engine and the design of a producer to deal with gas from bituminous coal of varying qualities.

SCOTTISH EXHIBITION OF ART AND INDUSTRY.

THE Scottish Exhibition of National History, Art and Industry, the buildings for which, at Kelvingrove, Glasgow, have been completed, and exhibits to some extent already installed, will be ceremoniously opened on May 3rd by their Royal Highnesses the Duke and Duchess of Connaught. Two important and highly successful exhibitions have already been held on the same site, *viz.*, in 1888 and in 1901; and while, as regards covered-in space, the forthcoming show will not equal that of 1901 in respect of area and of the number of separate buildings, either for instruction or entertainment, it surpasses the previous Exhibitions. Altogether about 54 acres of Kelvingrove Park are included in the Exhibition bounds (being one-third greater area than in the case of the 1901 Exhibition). Promoted largely with the avowed object of raising a fund to be applied primarily to the endowment of a chair of Scottish History and Literature in the University of Glasgow, the Exhibition is also so designed as to create a greater public interest in Scottish History and Literature; to celebrate the memory of distinguished Scotsmen; to present a realistic picture of Scottish burghal life in bye-gone times; and to exhibit those arts and industries in which Scottish people are or have been pre-eminent. Although thus essentially national in character, the project has undergone expansion since its conception, and will embrace not a few international features. Scotsmen, it is proverbial, find their way to the utmost parts of the world; so that it is not unfitting to find that much that is representative of "out-of-the-way" regions like Lapland and Japan, will find place in the Scottish Exhibition.

The most extensive, and, architecturally, the most imposing of the many buildings, is what has been named the Palace of Industries, which covers an area of 110,500 sq. ft. The term "palace" is applied to several of the main structures in the Exhibition, from the fact that one of the buildings—that in which is housed many priceless objects and historic relics concerned with Scotland as a nation and as a participant in the advancement of literature, art and industry—is a magnificent structure erected on the model of Falkland Palace, the ancient seat of the Kings of Scotland. Another of the main buildings, the Palace of Fine Arts, gives housing to a magnificent collection of paintings and sculpture representative of a century of Scottish art, and is enriched by many loans of great value not often found in public collections. No fewer than three bandstands with enormous capacity for audiences have been provided at different points throughout the Exhibition, as well as a superb concert-hall, having a grand organ, with accommodation for 5,000 people, and with a stage of unusual dimensions, capable of serving the purpose of historic pageants and tableaux. Still another of the principal buildings, and one in which our readers will be chiefly interested, is the Kelvin Hall, which covers an area of 22,700 sq. ft.

For lighting and power throughout the Exhibition, electricity as well as gas is everywhere in evidence, and from an engineering standpoint, one of the most interesting features of the Exhibition is the electric station equipment, which is housed in a handsome building in close proximity to the Palace of History and the Palace of Industry. The electricity supply is taken from the high voltage street mains of the Glasgow Corporation, and in the station is transferred from 6,500 volts a.c. to the lower rate of 500 and 250 volts. The transforming and other plant in the station consists of three 500 k.w. rotary convertor sets, each of 6-phase, 25 periods, 6-pole, 500 r.p.m. type; three 580 k.v.a., 25 periods, 6,500 to 390 volt, 3-phase, oil-immersed transformers, each with oil-immersed, drum-type controller for starting up from tappings on the a.c. side of the transformer; one 250 k.w. rotary converter set, with transformer and controller similar to above, but for 250 k.w. load. The plant capacity is equal to a total of 1,750 k.w. Cables are led from the high-tension switchboard, composed of seven cubicles or panels, to the transformers, controllers, rotaries, direct to the low-tensioned D.C. 4-panel machine-board; and from the bus-bars of same to a 10-panel D.C. distributor or feeder-board, each panel on the latter controlling one set of three single cables at 500 volts between the two outer, and 250 volts between the mid (or neutral) and outer cables.

The plant, consisting of high and low-tension switchboards, transformers, controllers and rotaries, has been supplied on loan to the Exhibition authorities as an exhibit by The British Westinghouse Electric and Manufacturing Co., Ltd., Manchester, with a view to be taken over and purchased by the Glasgow Corporation Electricity Department after the close of the Exhibition. From the electric station 10-panel D.C. distributor switchboard, the main cables are led underground to the various sections of the Exhibition for lighting, heating and power purposes. Over 10 miles of underground cable is involved, the cable used being supplied by the Standard Cable Manufacturing Co. It is of the stranded copper conductor, paper-insulated, lead-covered, steel ribbon armoured, jutted and compounded class, the total weight of cable used being over 100 tons, representing an actual value of over £13,000.

The Kelvin Hall, in keeping with the idea of memorializing the scientific work and inventions of the late Lord Kelvin, is largely given over to illustrating the evolution of and modern progress in electricity and associated branches of science and industry. Electrical apparatus and engineering appliances with which electricity is associated form the chief feature of the collection of exhibits; but shipbuilding, as exemplified by handsome small-scale models and large photographs, and marine engineering as concerned with recent developments in the way of internal combustion engines—oil and gas—are branches of industrial activity also worthily represented. In the central hall of the building are grouped the apparatus and articles—actual or by model representation—which owe their existence to the inventive genius and scientific attainments of the late Lord Kelvin; notably those connected with telegraphy, electricity and navigation. Messrs. Kelvin & James White, Ltd., Glasgow, the well-known firm with which the deceased scientist was associated, and which all along has produced the many scientific, electrical and navigational apparatus bearing his famous name, are represented elsewhere in the building by examples of the most up-to-date make of "Kelvin" compasses, sounding machines, etc. To the collection of exhibits illustrating the history of the submarine telegraph, contributions are made by Sir W. H. Preece, Dr. J. G. Gray (Lord Kelvin's successor in Glasgow University chair), Prof. A. D. Ross, the Royal Astronomical Society, and others. Interesting items are samples and actual parts of the first telegraph line, early cables, the Atlantic cables of 1857-8 and 1874; also of the first underground cables ever laid. Doctors Gray and A. D. Ross put on exhibition a Gray-Ross magnetometer designed for testing the magnetic properties of metals, also an electric resistance furnace.

In the large wings which lead off to east and west of the central hall are arranged all the engineering exhibits, those connected with shipbuilding being confined to the west wing. Quite a number of the exhibits will be shown in motion, the oil and gas engines using their respective fuels; but in most cases where the action is all that need be shown motive power will be electric. This also applies to the Exhibition as a whole. Amongst exhibitors of oil motors for marine purposes are Messrs. Wm. Beardmore & Co., Ltd., Dalmuir; the John Scott Engine Co., Ltd., Paisley; Messrs. W. & S. Pollock, Robertson St., Glasgow, etc. Air-compressors are shown by Messrs. Fleming & Co., agents for the Ingersoll-Rand Co., and by Messrs. John Macdonald & Son, Maryhill, the latter of whom also show several examples of an entirely new moulding machine. Electric motors for various purposes are shown by Messrs. Mavor & Coulson, Ltd., Glasgow; Messrs. Dick, Kerr & Co., Kilmarnock; Messrs. Anderson Boyes & Co., Ltd., Motherwell; Messrs. Paterson & Service, Bath St., Glasgow; Messrs. Garty, Bone & Co., Anderston Electric Works, Glasgow; and others. Messrs. D. & J. Tullis, Ltd., Clydebank, show a series of vertical radial drills for use in engineering and steel constructional works. Steel constructional material in a large variety of forms is shown by the Glengarnock Iron and Steel Co., Glengarnock; the Glasgow Iron and Steel Co., Wishaw; etc.

Conspicuous amongst the shipbuilding exhibitors are Messrs. Wm. Denny Bros., Dumbarton; the Fairfield Shipbuilding and Engineering Co., Govan; Messrs. Wm. Simons and Co., Renfrew; Messrs. Lobnitz & Co., Renfrew; and Messrs. Alexander Stephens & Sons, Linthouse. In keeping with the idea of giving prominence to objects of historical interest, and illustrating the evolutionary steps in shipbuilding progress, most of the firms named have not only shown striking examples of their recent productions, but have arranged, in juxta-position with them, models of the class and type of ships built for the same purposes at earlier stages of development. Thus, Messrs. Denny Bros., alongside of the model of p.s. *Lochlomond*, one of the earliest steamers to navigate the "Queen of Scottish Lakes," show a fine model of the Clyde passenger turbine steamer, *Queen Alexandra*; alongside a model of the composite gun-boats *Kwang Tung* and *Shang Tung*, built many years ago for the Chinese Government, and a model of a first-class torpedo-boat of the 26-knot class built recently for the British Government. Besides a variety of models showing typical modern ocean liners built by the firm, the collection includes several models representing craft in the production of which Messrs. Denny are quite specialists, *viz.*, the many-decked, light-draught, river paddle-steamers, owned by the Irrawaddy Flotilla Co. A noteworthy item also is a fine model of the palatial steam yacht *Lysistrata*, built a few years ago for Mr. James Gordon Bennett, of New York. The same idea of illustrating steps in development as well as the most recent productions is evident in the exhibits from the firms engaged in the building of dredgers and dredging craft—Messrs. Wm. Simons; Lobnitz & Co.; etc.; but in their case it was not possible at the time of our representative's visit to note details. To this and other features we will refer more fully in our June issue.

Of great interest to visitors whose calling is in any way associated with shipping and marine engineering, will be the processional pageant on the river Kelvin of historical and typical ships. It is, of course, intended that this feature shall worthily typify Glasgow's and Scotland's part in the origin and development of steam navigation, especially emphasising the great epoch-making event of the building of the steamboat *Comet*, exactly one hundred years ago. The *Charlotte Dundas*—forerunner of the *Comet*, as of the pioneer steamer *Clermont* on American waters—which, with engines by Wm. Symington, successfully demonstrated in 1802 steam navigation on the Forth and Clyde Canal, will also be prominently represented. The history of Scottish shipbuilding, in fact, from the "dug-out" and "coracle" times down to the days of "Lusitanias" and super-"Dreadnoughts," will be represented by large scale models capable of being navigated. In the case of the *Lusitania*, the length of model is about 38 ft., and it weighs about 3 tons. Amongst the ships of historic note represented will be the *Great Michael*, "ane monstrous schipp" of James IV., built at Newheaven; the pioneer Cunard liner *Britannia*, built at Port-Glasgow; the latest Cunarder, *Lusitania*, built at Clydebank; while in addition to a model of one of the latest "Dreadnought" battleships, there will be five models representative of the *Resolution* and some models typical of gun-boats and torpedo-destroyers. Altogether some twenty or twenty-two models will take part in the historic marine procession, which will take place twice daily, the miniature ships being each propelled by apparatus in the interior, and during processions in the evenings the vessels will be illuminated. In the case of the naval ships also gun firing and its effects as regards damage to opposing vessels will be represented with striking fidelity to the actual events. The creation of this mimic navy has been under progress for months past in one of the buildings in the Exhibition grounds, the "naval constructor" being Lieutenant Morgan, assisted by a staff of clever artizans. Lieutenant Morgan, who went through the Spanish-American war as Lieutenant in the U.S. Navy, has been associated with large exhibitions in Europe and America for twenty years, at which his naval displays have been a feature.

THE CORROSION OF METALS.—The Corrosion Research Committee of the Institute of Metals is now actively engaged in preparing for an elaborate series of investigations into the causes of the corrosion of brass condenser tubes. A special condenser is being constructed, which will contain forty-eight tubes, twenty-four of these being made of commercially pure brass, the remaining twenty-four tubes being made from brass containing a single selection from the following: lead, tin, aluminium, manganese or other materials at the discretion of the committee. Experiments will be made with various water speeds in the ratio of 0 : 1 : 2 : 3 : 4, speed 2 being an average speed used in practice. The circulating water to be used will be obtained from deep water at Formby, off Liverpool, in the first instance, and the plant for the corrosion research will be installed in the University of Liverpool, where the experiments will be under the direct supervision of Mr. G. D. Bengough, M.A. An appeal was recently made by the Committee for funds to carry on the research, and in response to that appeal various donations have been received. It is earnestly hoped that additional donations to the Corrosion Research Fund will be speedily forthcoming from those interested in the corrosion of condenser tubes, and who desire to see discovered a remedy for this old-standing trouble. Donations should be sent to Mr. G. Shaw Scott, M.Sc., the Secretary of the Institute of Metals, at Caxton House, Westminster, S.W.

SOME PROBLEMS RELATING TO THE USE OF THE INTERNAL COMBUSTION ENGINE FOR MARINE PROPULSION*.

By P. B. NEWELL, Esq., Member.

IN this paper it is proposed to fairly state some of the problems which the marine explosion engine designer encounters and to show how they have been, or can be solved.

Probably all the difficulties come under the following four heads:—(1) Low cost of working. (2) Reliability without undue attention. (3) Reversibility. (4) Adaptability to large vessels.

Unfortunately the writer has found it impossible to keep to these heads in describing the various ways in which difficulties may be overcome.

Where steam raised by coal is the propulsive agent, the average cost of fuel may be taken as half a farthing per horsepower hour, but to get the working cost at least one man's time must be added for any boat above a few tons' displacement. The cost of putting fuel aboard, of raising steam, and cleaning boilers must also be considered.

From the accompanying table of working costs of internal combustion engines the actual fuel is seen to be more than half a farthing in many cases, but very little, if any, attention is required.

Fuelling is very cheaply effected. The necessary stores, tools, etc., are considerably less than when a steam raising plant is aboard.

It would be very difficult to arrive at the comparative nett costs, as they vary considerably for different types and uses of ships, so that this has not been attempted. An obvious advantage, however, is the enormous saving of space when boiler and, to some extent, bunkers are not needed.

A load of one hundred tons of crude oil gives the same radius as a load of three hundred tons of coal, and the oil only occupies about three-quarters of the space required by the coal.

* Read at the North-East Coast Institution of Engineers and Shipbuilders, Newcastle-upon-Tyne.

As an example, the *Vulcanus*, a vessel of 1,900 tons, built at Amsterdam, has a six-cylinder four-cycle 500 H.P. engine, running at 180 revolutions per minute, which only weighs 42 tons, though all parts were made extremely heavy for hard usage. The total machinery installation weighs 85 tons; the auxiliaries are worked by compressed air reduced from 300 pounds per square inch to 80 pounds. The boat has a spacious engine room, where a stove is needed in cold weather, and where the boilers ought to be cargo is stored.

In passing, the wonderful flexibility of the engine is worth noting; the highest revolutions on the maiden trip were 160 per minute, and the engineer, new to the engine, got them as low as 84 per minute, but they could be reduced by merely throttling the oil supply to only 58 per minute. The total machinery staff numbers only four.

The only objection raised was the somewhat offensive smell of the crude oil. Those of us who have been on oil fuel boiler tests or sea trips can sympathise.

Another example is given in the Appendix where a Diesel type engine took the place of a steam engine.

Figs. 4 and 5 show comparative designs actually made for a passenger and cargo boat, the former with crude oil engines and the latter with steam engines. The comparative weights are 70 tons for the two oil engines and 120 tons for the whole installation, against 120 tons for the two steam engines with two boilers full of water, and 180 tons for the whole steam installation, both exclusive of fuel.

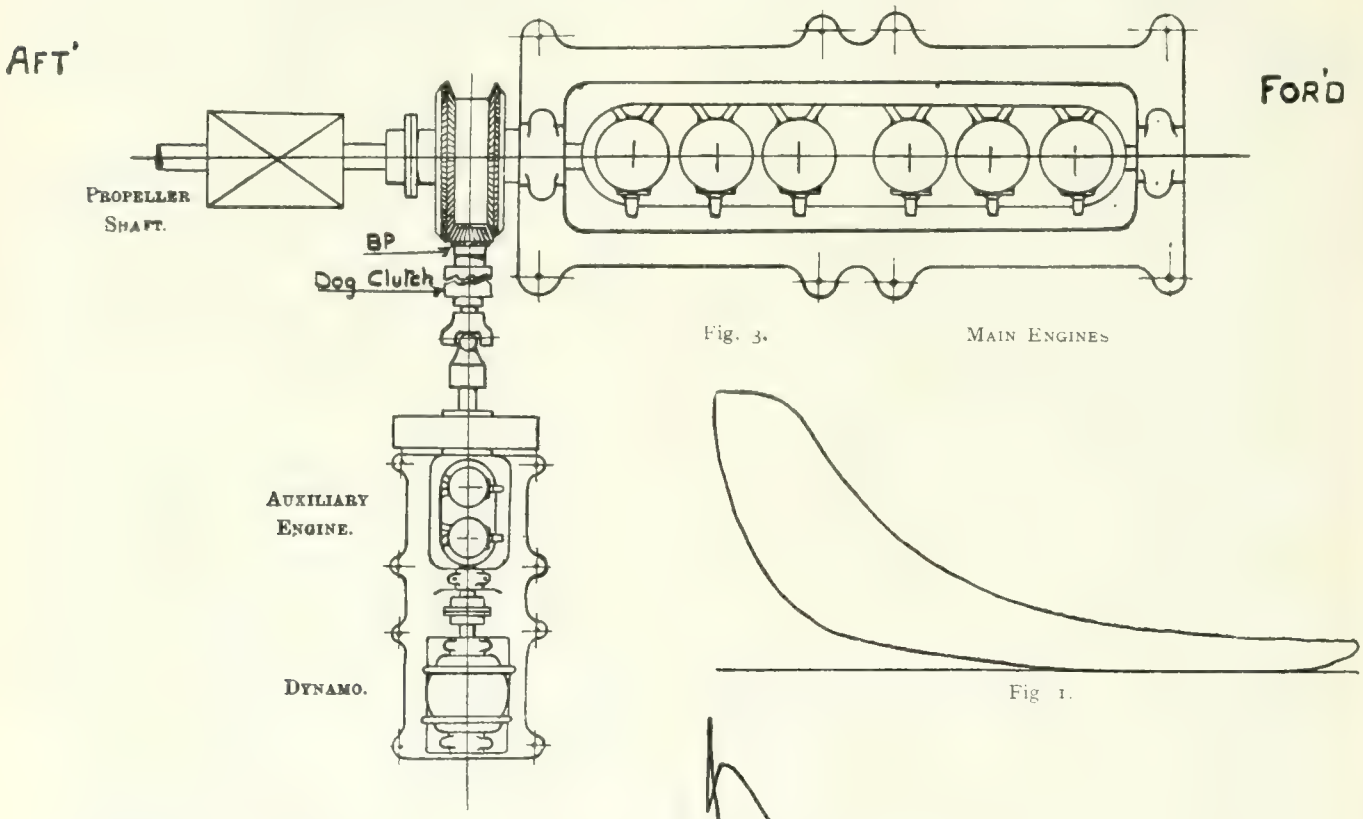


Fig. 3. MAIN ENGINES

Fig. 1.

Fig. 2.

The average working cost of gas producer marine engines from the few examples available appears to be about .05 pence per H.P. hour.

Many a steam engineer's impression of an internal combustion engine is that it takes a good deal of starting and very little stopping. Anyone who stands in front of a boiler and sees the rising pressure gauge realises that something has got to move, but with the explosion engine nothing can be seen and the source of power is mysterious.

If the engine has to be turned by hand to start it, the propellor must be disconnected, and, even with the engine free, difficulty in starting is encountered. With a good engine, however, and a man who remembers to attend to such necessary preliminaries as turning on the fuel supply, trouble is very rare.

A good engine is one that does not overheat and keeps clean inside, besides developing full power at low consumption. Even when using good lubricating oil and petrol, it is in many cases found necessary to open out the engine to clean some part of it.

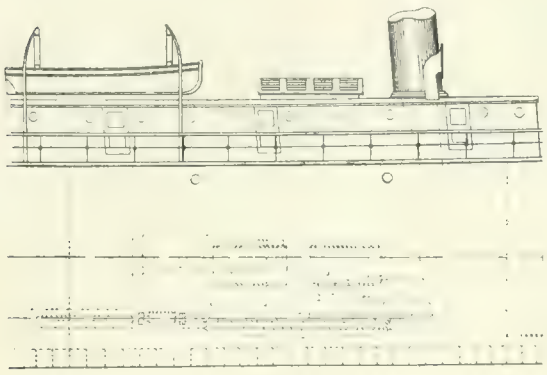


Fig. 4.

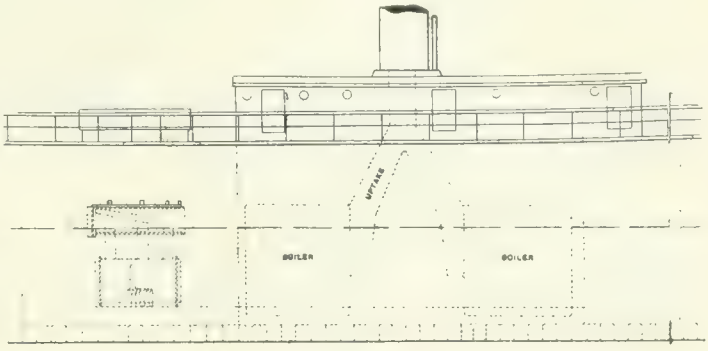
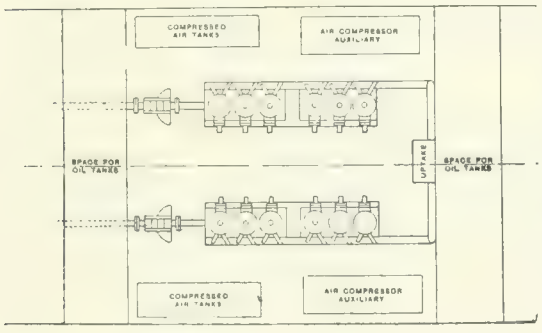
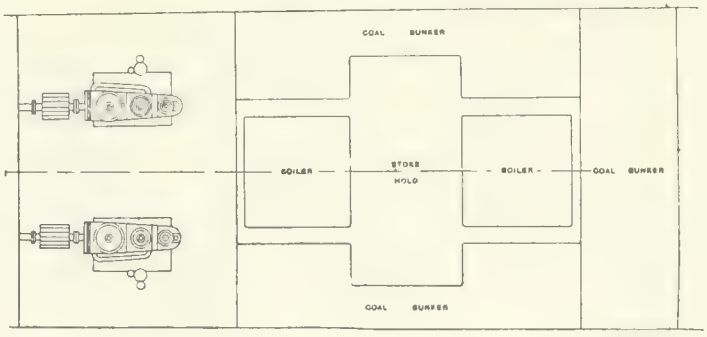


Fig. 5.





On the other hand, many instances can be quoted to show that this problem can be solved. Not a few of our fishing boats run for days without stopping and without constant attention. A Diesel oil engine started running on land in April last, was still running in November, and, for all the writer knows, is running yet, and the fuel for it is crude petroleum.

The fact that our Royal National Lifeboat Institution have now a number of internal combustion engines in lifeboats doing excellent service, is another proof of reliability of small powers.

The enormous stresses produced by high explosions, high revolutions, and absence of cushioning mean short life to any but the best engines, and it is by the quality of material and workmanship that the difficulty is met. Reliability cannot be attained by the same means in large powers, but this will be discussed shortly.

Perhaps no steam engine is ever tested for reliability without attention in the same way as its rival, which is often packed away with its reverse gear under a deck, and after a man has crawled to it to start it, is left to drive the boat seaward and homeward, ahead and astern.

A great objection to the class of power agent under discussion is that it usually requires a flywheel to carry it round part of the revolution, and therefore there is a heavy mass to stop and start before reversal can be effected. There are many ways of overcoming the objection, and the writer has endeavoured to fairly describe each method.

The problem of reversing in a steam engine is comparatively simple, as the medium employed is perfectly flexible and the engine and all its various parts can be reversed slowly and without shock or undue strain. In the explosion engine, however, unless there is a large reserve of compressed air or other flexible medium, the reversing is always accompanied by a series of shocks, due to the too sudden acceleration of all the heavy moving parts. Reversing the weight of the propeller is bad enough, but reversing the whole of the machinery by means of a series of sledge-hammer-like blows is infinitely worse, and up to the present, at any rate, the problem seems best solved by a reversing mechanism which will take up the drive of the engine gradually and transmit it to the propeller.

Various reversing gears, working on different principles, are on the market for accomplishing this ; one type works on similar lines to those adopted in modern car practice—a pedal-operated friction clutch engages with the engine, and the shaft coupled to this clutch enters the forward end of the gear box, where it is furnished with a gear wheel and a claw clutch. By means of a hand-operated lever, the claw clutch can be engaged with a similar claw clutch on the propeller shaft to obtain the "ahead drive," or the gear wheel can be engaged with a train of gear wheels on lay shafts inside the gear box, and so to a gear wheel on the propeller shaft, to obtain the "astern" drive.

In another type the engine is direct coupled to a shaft inside the gear box, on which is mounted a gear wheel—the first, or driving member, of a Jack-in-the-box gear. The casing is supplied with a friction clutch, which can be engaged at will, either with a friction clutch on the propeller shaft for the ahead drive or with a stationary friction clutch mounted rigidly to the frame, which locks the casing and so allows the gear wheels inside to revolve and reverse the propeller shaft.

Most of the gears at present on the market are worked on one or the other of the two principles above, and there are several objections to both systems : amongst others may

be mentioned the following:—Thrust springs to keep clutches engaged; toggle joints, which need frequent adjusting; band brakes, which tend to throw the gear out of alignment; gear wheel teeth take the whole of the ahead drive; multiplicity of operating levers, making distant control difficult.

Figs. 6, 7 and 8 show the "Hesse" reversing gear, in which the above difficulties have been ingeniously eliminated. The engine is direct coupled to the thrust shaft shown (Fig. 6), on the inner end of which is keyed a cone friction clutch, machined inside and out. The propeller shaft has a cone clutch keyed to its forward end; between this and a collar further along the shaft is mounted loosely the reversing mechanism, consisting of a cone clutch, a set of bevel wheels, two of which are mounted on a trunnion, and a dog clutch. The whole of peller clutch, which thus takes the drive to the propeller (see Fig. 7).

In some cases the blades of the propeller itself are reversed. Reversible propellers have their blades arranged to swing round on their axes to drive astern; they are useful in sailing boats, where the blades can be swung half round and offer little resistance to the water and have no tendency to idly rotate. The blades, and cranked arms inside the propeller boss for turning them, have to be made very strong to ensure against breakage.

Two propellers, one right hand and the other left hand, have been used for reversing, but the high resistance of the idle propeller, or the difficulty of putting it in a casing when not wanted, has caused even marine internal combustion engineers to relinquish the idea.

Another method of reversing is shown in Fig. 3, the

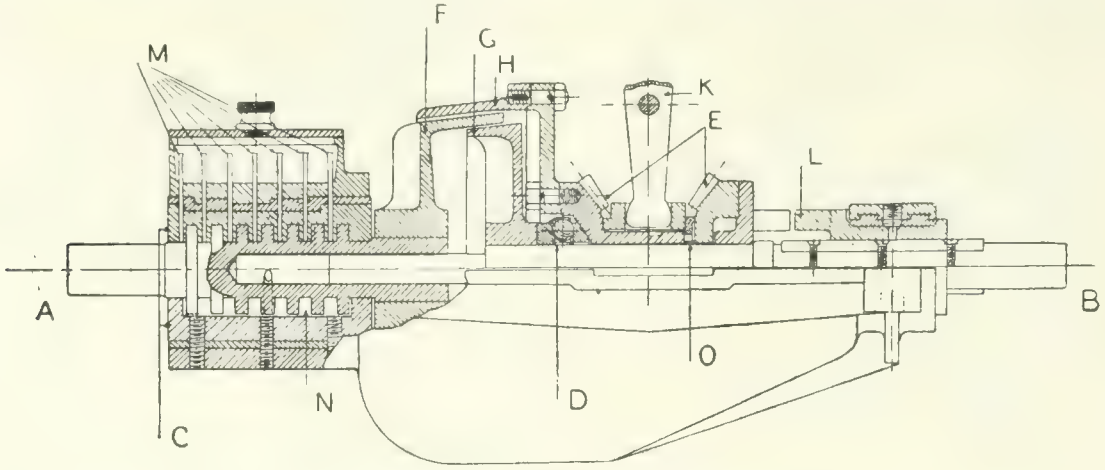


Fig. 6

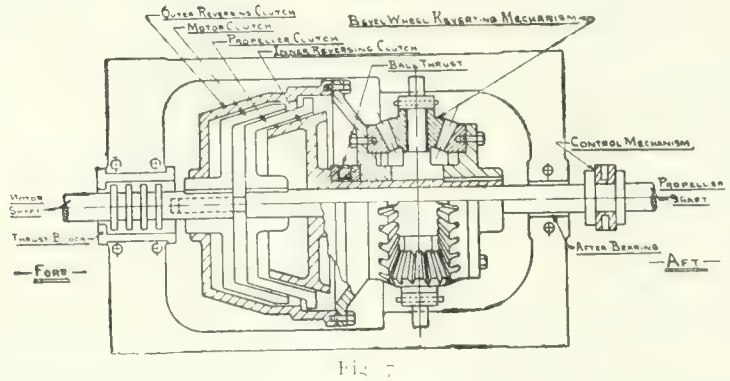


Fig. 7

this mechanism is quite free during the ahead drive.

To go ahead, the whole of the propeller shaft, including the propeller, is moved slightly forward by means of the lever provided, and the ahead clutch engages with the motor clutch; the thrust of the propeller being thus transmitted directly along the shaft, through the clutches, keeps the clutches in engagement and is absorbed in the thrust block. It will be seen that as the torque increases the thrust also increases without the intervention of springs or other special arrangements to keep the clutches engaged.

To go astern, the propeller shaft is moved aft, and the dog clutch on the reversing mechanism is engaged with the dog clutch on the propeller shaft; further movement aft engages the astern clutch with the motor clutch, when the pull of the propeller again serves to keep the clutches in engagement.

With high powered, high speed motors a modification is made in the design which does away with the dog clutches. In this design an inner reversing clutch, connected to the aft gear wheel by a sleeve along the propeller shaft, engages with the inner surface of the pro-

separate engine being used as an auxiliary as well as for starting and reversing. The objection is that the bevel pinion cannot be brought into engagement until the bevels on the flywheel are stationary, which results in reversing being a long operation.

The time taken in reversing is an objection in many reversible engines, and for certain classes of boats which have much manœuvring to do reverse gears are fitted to the so-called reversible engines.

One of the simplest reversible engines is the Bolinders type.†

So far, not very large boats have been tried with oil engines because of the difficulties or dangers. Two of the dangers are racing due to broken shaft or propeller out of water, and an explosion perhaps more powerful than usual at the wrong time.

It is necessary to properly govern a large engine, to effectively cushion and balance the pistons, and to ensure

† *The Marine Engineer and Naval Architect*, January, 1910, contains an illustrated description of the Bolinders type of engine.—Ed. M.E. & N.A.

that explosion only occurs at the right time.

Compressed air is used to start and reverse large engines, and it could be used in connection with the governor to provide the quick increase of power necessary when the propeller dips into the water after its racing out of the water has caused the governor to shut off the fuel supply.

The untimely explosion danger is eliminated by timing the injection of fuel to take place just at the right time, and by driving the exhaust, which might really be unexploded mixture, into contact with a water spray. Overheating of piston rods, in the case of double-acting two-cycle engines, such as one of the Diesel types, is prevented by oil-cooling or air-cooling from a fan.

A very large engine really needs a far more flexible power agent than ever a series of explosions can be, and a method of attaining this ideal is by having a separate chamber for the explosion, connected to the cylinders by valves, reducing valves if necessary, and then expanding the gas once, twice, or thrice, as in the steam engine. The high pressure piston, which would suffer from the gases at their hottest on its top side, could be used on its bottom side to compress air to be injected into the combustion chamber ; the other cylinders being double acting. Alternatively, an ordinary double acting expansion engine, with an air compressor driven off the crosshead, pumping air into two chambers alternately, which automatically fuel and fire and switch over (say on a Pulsometer pump principle) from one to the other.

GENERAL ARRANGEMENT
OF
THE HESSE (Patented) MARINE REVERSE GEAR.

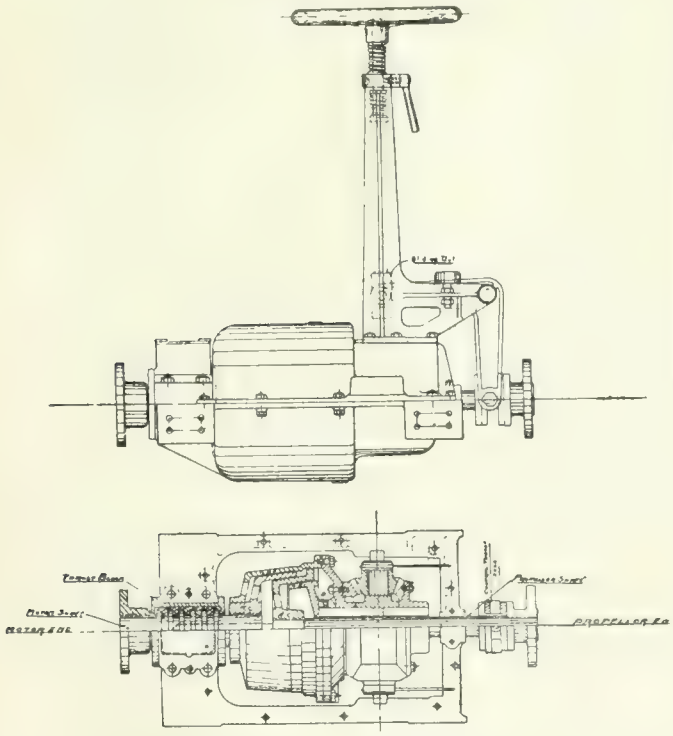


Fig. 8.—HESSE REVERSE GEAR.

No. 2 Principle, without Dog Clutch.

M.C. represents Motor Clutch (keyed to motor shaft).
A.C. ,, Ahead Clutch (,, propeller shaft).
O.A.C. ,, Outer Ahead Clutch.
I.A.C. ,, Inner ,, ,,
B. ,, Ball Thrust.

A truism of great encouragement is that it is only in detail that a well-thought-out installation comes to grief—a hot bearing, a leaky condenser, or merely the failure of one of many thousands of boiler tubes.

The illustrations not referred to are Figs. 1 and 2, indicator diagrams, at half speed and full speed respectively, of a crude oil engine, and show the gradual explosion possible.

The writer wishes to express his high appreciation of the assistance rendered him in the preparation of this paper by Mr. R. J. Brookes and Mr. A. W. Sadler, and also to thank Mr. A. Landells, Junr., for reading the paper at this meeting of the Institution.

Vessel on Lake Zurich.

Steam Engine.	Diesel Engine.
14 kilometres.	20 kilometres.
70 H.P.	150 H.P.
14,700 kilograms, weight of machinery with water and coal for 120 kilometres radius.	9,750 kilograms with oil for 1,200 kilometres radius.
100% space occupied by machinery.	80% space.
2 men.	1 man.
8·5 kilograms coal per kilometre.	1·4 kilograms oil per kilometre.
Cost of fuel, 100%.	25% with 34% increase of speed.

Table of Working Costs.

Type of Engine.	Fuel.	Cost of Fuel per H.P. Hour.
Steam boat	Coal, 13s. 6d. per ton	0·11d.
Producer gas engine ..	Anthracite, 22s. 6d. per ton	0·12d.
Fishing boat, 2 cycle engine	Paraffin, 5½d. per gall.	0·4d.
Fishing boat, 4 cycle engine	Do.	0·395d.
Cargo boat, 76 H.P. ..	Do.	0·375d.
Small Bolinder type engine	Crude oil, 40s. per ton	0·212d.
Large Bolinder type engine	Do.	0·135d.
Large Diesel type engine ..	Do.	0·1075d.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(*From our Own Correspondent.*)

Devonport Dockyard.

THE new battleship *Centurion* is making good progress, and by now there has been built into her about half her launching weight. The armoured cruiser *Lion* will be ready for the pennant in November. She is making excellent progress, and all her three funnels are now in position. The *Indefatigable* was recently in the same basin, and it was thus possible to compare the points of difference between the two vessels. The belated acceptance trials of the *Indefatigable* have been satisfactorily completed, and the vessel has now been transferred to the Admiralty. Since the vessel was commissioned for service in the First Cruiser Squadron at the end of February she has had her steam-pipe joints remade by the contracting engineers, and during the acceptance trial some of the 4-inch guns were fired to test certain work which had been carried out in their vicinity. The repairs to the battleship *Collingwood* rendered necessary by her having grounded at the entrance to Ferrol Harbour have been completed. The cruiser *Europa* has been taken in hand for repair. All her four funnels have been lifted out, an examination having shown them to be much worn and decayed. Another vessel in hand is the destroyer *Acorn,* whose injuries extend from the upper deck almost to the level of the keel, both decks having been cut through for a length of over nine feet. It will be necessary to rebuild the starboard stern section from the bulkhead aft. The steam yacht *Rainbow,* which has been purchased by the Admiralty, has arrived from Southampton to replace one of the tenders to the *Vivid.* The old battleship, *Impregnable,* is to be replaced as the training establishment for boys by the cruiser *Powerful,* which is now the flagship on the Australian station. The training establishment consists of three vessels. The *Impreg-*

nable herself has been fitted up as a wireless and general signalling school ; the second vessel, the old *Inconstant,* is for gunnery training ; while the third vessel, formerly the *Black Prince,* is for seamanship instruction. It is expected that shortly the lads will be given elementary electrical and torpedo instruction. Three battleships of the Fourth Division of the Home Fleet have been removed from the effective list. The *Ramillies* and *Resolution* have gone to the Motherbank to lay up, and the *Nile* has been placed on the sale list. The latter vessel was to have been sold on April 4th, but was withdrawn as she could not be got ready in time. The battleship *Repulse* is also to be sold. All four vessels were launched in 1892, so no useful purpose would have been served by keeping them in commission. Admiral Sir William May succeeded Sir Wilmot Fawkes as Commander-in-Chief on April 11th, and next day Admiral Fawkes, who would have reached the age for retirement at the end of the year, anticipated events and left the Navy. Engineer-Captain Anstey, who eighteen months ago succeeded Engineer Rear-Admiral Wishart as manager of the engineering department, has been appointed assistant engineer-in-chief of the Navy, in place of Engineer Rear-Admiral Mayston, who has retired on account of age. Engineer-Commander James has come here from Portsmouth to succeed Captain Anstey.

Portsmouth Dockyard.

At the beginning of the month there were five vessels of the *Dreadnought* type at this port—the battleship *Dreadnought,* the old flagship of the Home Fleet ; the battleship *Bellerophon,* which has been temporarily acting as flagship ; the battleship *Neptune,* which has been prepared for service as flagship, and which left to commence her duties on April 18 ; the battleship *Superb,* which is being generally overhauled ; and the armoured cruiser *Invincible,* which is undergoing her annual refit. Vice-Admiral Sir Francis Bridgeman, who took command of the Home Fleet last month with the acting rank of admiral, has now been promoted to that rank. The battleship *Orion* is being got ready for her trials, which, as already stated, are to take place during the month of June, and the battleship *King George V.* is making excellent progress. The Coronation Naval review arrangements are being proceeded with. At the review of the Home Fleet by the late King Edward four years ago the vessels were in the Solent, but it is understood that the review in June will be at Spithead. The Admiralty yacht *Enchantress* has been placed in dry dock to be prepared for service during the Coronation festivities. The *Dreadnought* is also to be ready for the review, but there is a lot to be done on her. The turbine machinery is to be thoroughly overhauled, the wireless arrangements are to be brought more up to date, and it is understood that the new fire-control arrangements which have proved so successful in the *Neptune* are to be fitted to the guns, while there is also a long list of minor defects to be made good. After the review the vessel is to rejoin the First Division of the Home Fleet. The destroyer *Bonetta,* while passing through Spithead on April 3rd with several other vessels of the Fourth Flotilla on return from Scotland, met with a mishap, the ferry vessel *Harlequin* drifting on to her and damaging several of her plates. The cruiser *Retribution* has been sold for £12,500. She is a vessel of 3,600 tons, and was launched twenty years ago, her cost having been £180,000. The berthing committee, under Vice-Admiral Giffard, have recently paid us a visit, and with Rear Admiral Tate, the admiral superintendent, have visited the various creeks and upper reaches of the harbour. It is practically certain that their recommendation will be for an extension of accommodation for berthing vessels. On Sunday, April 9th, in the Dockyard Church, Archdeacon Wood, the Chaplain of the Fleet, dedicated a carved pulpit, erected by Lady Barry to the memory of her late husband, Vice-Admiral Sir Henry Barry, who was admiral superintendent here during 1905 and 1906. The service was attended by Admiral Sir Arthur Moore, the Commander in Chief, and his staff, Rear Admiral Tate, the admiral superintendent, and other officers. Engineer-Commander James has gone to Devonport as manager of the engineering department at that yard, his successor as first assistant to the engineer manager here being Engineer-Commander Grant, who lately served in the cruiser *Challenger* on the Australian station.

Chatham Dockyard.

The protected cruiser *Chatham* is making good headway. She has now been nearly four months under construction, and a date for her launch will soon be announced. The slip on which she is being built is the one on which the tugs *Firm* and *Alliance* were constructed last year, so we cannot build any similar small craft for the present. Our other new work in hand is four submarines. The *Berwick,* of the Fourth Cruiser Squadron, has completed her refit, but the flagship *Leviathan* is still in dockyard hands. The *Berwick* has gone on a cruise until May 12th, by which time it is expected that the *Leviathan* will be ready. The squadron will shortly after go to sea for its first cruise under Rear-Admiral Bradford. The battleship *Dominion,* of the Second Battle Squadron of the Home Fleet, came in for her annual refit on April 10th, and the repair ship *Cyclops* has also been taken in hand. Another vessel to arrive for a refit is the cruiser *Boadicea,* the ship of the commodore of the First Destroyer Flotilla. The battleship *Africa* has had her defects remedied and has been commissioned for service as flagship of Vice-Admiral Prince Louis of Battenberg, commanding the Third and Fourth Divisions of the Home Fleet. The duties of flagship have been carried out by the battleship *Bulwark* since Prince Louis hoisted his flag a short time ago. The surveying vessels *Triton* and *Hearty,* which were overhauled during the time they were laid up here for the winter, have gone to Sheerness to complete for sea, after which they will commence their season's duties. The cruiser *Antrim* was passed out of dockyard hands on April 17th on the completion of her annual refit, and has since resumed duty with the Nore Sub-Division of the Home Fleet. The battleship *Formidable* has been paid off and recommissioned for further service with the Atlantic Fleet, and the cruiser *Barham* has returned from the Mediterranean and paid off and recommissioned for service on her old station. The battleship *Trafalgar,* of the Fourth Division of the Home Fleet, has been paid off and placed in charge of a care and maintenance party. She was to have been offered for sale on April 4th, but could not be got ready in time. The *Trafalgar* is a vessel of 11,940 tons, and she was launched in 1887, so it was not much use showing her as an effective war vessel. Lieutenant E. Davis, who had been naval recruiting officer at Chatham for the past two years, has been appointed by the Marine Society to be its representative and shipping agent in the South Wales district. Lieutenant Davis, who was a chief boatswain, retired from the Navy with the rank of lieutenant nine years ago. His successor at Chatham is Lieutenant T. Holman.

Sheerness Dockyard.

Almost all the twenty ocean going destroyers of the 1909-10 programme have now been delivered, and have joined the Second Flotilla. In a very short time the First and Second Flotillas will consist entirely of ocean going destroyers—twelve of the 33-knot "Tribal" class, and thirty-six of the 27-knot vessels. The *Lyra,* one of the new boats which recently joined the Second Flotilla, when exercising with the flotilla near Kirkwall on April 7th went ashore on the island of Gairsay, but did not sustain any damage. The "River" class of vessels as they are being relieved in the Second Flotilla are joining the Third (Nore) Flotilla, which the *Erne,* which has undergone a refit, at Haulbowline, has also joined. The destroyer *Express,* has arrived from Devonport and has been taken in hand for retubing. On the completion of her refit she will be recommissioned for service in the Fifth Destroyer Flotilla at Devonport. At the end of May the *Recruit,* of the same flotilla, is due from the western port. She is also to be retubed. No. 94 yard craft, which was built at Chatham for service as a mooring lighter and submarine salvage vessel, has arrived here to begin her duties. With regard to submarines, it has been announced that Submarine A1 has been struck off the effective list and is to be sold. A few months ago she was towed round to the Medway from Portsmouth and used for experimental purposes. It was this vessel, it may be recalled, which met with disaster seven years ago while carrying out exercises in the Solent. She was

struck by the steamship *Berwick Castle,* and sank, two officers and nine men being drowned. It took a month to get the submarine up and she was repaired and passed into the service again, but she was not used much afterwards. A well-known vessel, which was built at this yard, will also soon be placed on the sale list. The vessel is the *President.* Her name originally was the *Gannet,* and she was launched in August, 1878. Her name was altered to *President,* when she took over the duties of the vessel of that name at the West India Docks as a Royal Naval Reserve drill ship about five years ago. The name *President* has been retained in the "Navy list" as a number of officers are borne on the books who hold appointments at the Admiralty, in the Coast Guard, and on other duties. The sloop *Buzzard,* the drill ship of the London division of the Royal Naval Volunteer Reserve, which is moored in the Thames off the Temple, has been renamed *President.* The *Buzzard* was also built at Sheerness, but launched nine years later than the *Gannet.*

Pembroke Dockyard.

Seeing that the cruiser *Amphion* has only been under construction for six weeks, very satisfactory progress has been made with her. The arrangements are that she is to be launched in October, or probably earlier, and prepared for her trials about next May. After the launch of the *Amphion* the new ship will be got on with. With regard to the *Active,* the twelve Yarrow water-tube boilers which constitute the boiler installation of that cruiser have been put in place. The turbine propelling machinery, however, will not be delivered until June. The delay has caused some inconvenience and extra expenditure will be involved, as the vessel will have to be again opened out. The *Active* will probably be ready for her steam trials in October, and she should be in commission early next year. The cruiser *Blonde,* which is completing for sea, will be commissioned in about six weeks' time. The destroyer *Cheerful,* which has undergone a thorough repair refit, has been completed. The refit included the retubing of the water-tube boilers and a complete overhaul of the propelling and other machinery, to which in most cases new bearings were fitted. The *Coquette* is still in hand, and another destroyer, the *Itchen,* has come in for a refit, while the *Kennet* is daily expected to arrive from Devonport, to be retubed. The other refits in hand are those of Torpedo boat No. 049 and the tug *Alligator.* The work of refitting destroyers was first assigned to the yard just over two years ago, and five vessels have since undergone thorough repair and two ordinary refits. We shall be able to deal with a larger number of destroyers after the completion during 1912-13 of the new patent slip, officially described as improved docking accommodation for destroyers, upon which £13,500—about half the total cost—is to be expended during the present financial year. Two coal barges sank at moorings off the yard during a severe gale in December and both have now been salved. The salvage must be considered highly creditable, seeing that the staff for that work is a very small one. The first of the barges was raised several weeks ago, and has been thoroughly repaired.

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

The Battle of the Ports.

THE excitement which the promised appearance of the Cunard flag at Southampton is causing in the minds of those connected with that port is somewhat amusing. The Cunard Company has bought three twin screw passenger and cargo steamers. It has bought them because with them it gets an entry, on established terms, into the Canadian trade. The steamers in question have been in the habit of sailing from the Thames and of calling at the Hampshire port to embark passengers. Under their new management they are to continue to do what they have been in the habit of doing. That is all. What else could have been expected? It would hardly have been likely that a hard-headed management—such as the Cunard Company now boasts—would have transferred the steamers to the Mersey, as soon as it purchased them. Such a policy would have simply meant that the goodwill and connection which was part—and perhaps one of the most important parts—of their purchase would have been ruthlessly and unnecessarily slaughtered.

The first sailing of the new branch, by the way, is appointed for the 2nd May. It will be taken by the *Albania,* as the old *Cairnrona* is now called. The *Tortona* will follow a fortnight later under the name of *Ausonia,* whilst the *Ascania*—under which name the vessel launched as the *Gerona* will be registered—will be ready to make her maiden departure on the 23rd May.

Meanwhile Manchester has had a loss—the steamships of the Elders and Fyffes Company having signified their intention of moving their headquarters to Garston in January, 1912. The reason put forward for the change is that they find Garston more convenient, whilst the Ship Canal itself is a handicap to their trade.

This is the first time that an adherent of the Ship Canal Company has, so far as I can remember, left the port of Manchester. But I doubt if it will be the last. Manchester is undoubtedly doing all it can to facilitate traffic, and it is constantly endeavouring to deepen its channels and ease the curves of its waterway. But when all is said and done, the standard size of cargo steamships is creeping up all the time, and—as long as sufficient cargo offers—the larger the ship the cheaper can she shift her dead weight. Thus it comes that the big ship is the best investment for the shipowner, whilst she may be able to offer a lower rate than the smaller vessel. A time will come, therefore, if increase in size continues, when Manchester will be a costly port for reasons outside the Ship Canal dues. That time, however, has not yet come. The reason for Messrs. Elder & Fyffes' preference for Garston is obviously the facility which the London and North-Western Railway can offer to its customers. Without much fuss it has been developing Garston for years. The principal dock has now an entrance 65 ft. wide and has a depth of water over the sill of 35 ft. on spring tides and 25 ft. at neaps. Seventy miles of railway sidings have been provided, eight miles of these being actually alongside the quays. These of course are in direct communication with the Company's main line system to Liverpool, Manchester and the South.

To meet Messrs. Elders and Fyffes' requirements a banana receiving shed, 400 ft. long by 90 ft. wide, is being erected, as well as suites of offices for the Company's staff. It is said that the import by the firm is rapidly increasing—the shipment in April, 1910, having been 100,000 bunches, whilst for the corresponding month of the present year the orders placed amount to double that figure. Meanwhile the Railway Company is deepening the channel from the Mersey to its docks' entrances so that—should Messrs. Elder and Fyffe's move be an encouraging one—they will be in a position to accept new customers for the facilities they provide.

The White Star Line.

The new steamship *Olympic* was safely dry docked in the new graving dock at Belfast on the 1st April, and she is now being rapidly prepared for sea.

Another Combine steamer the *Ottoman,* recently registered in the name of the British and North Atlantic Steam Navigation Co., of Liverpool, has been removed from the list, having been sold to Messrs. T. W. Ward and Co., of Sheffield, for breaking up. No sooner was the sale announced than the vessel was taken round to Preston to be dismantled. On her way thither, however, she met with a mishap, going ashore on the breakwater just outside the breaking-up berth. The *Ottoman* is a vessel of only 4,843 tons gross register, and was built by Messrs. Laird's, of Birkenhead, as recently as the year 1890. She had single screw and triple expansion engines. The fact that she is now completely obsolete does not surprise one when one regards her details. But what does seem strange is that but twenty years ago vessels so different to those now found suitable for the North Atlantic trade should have been specially designed and built for it.

The British and North Atlantic Company were the owners of some of the finest vessels employed in the Dominion Line service. But these were soon after the Combine was effected, transferred to the White Star, three of the smaller steamers which it owned have been disposed of to

shipbreakers since 1909, and at present, I fancy it owns but a few steamers, though, of course, it shares the general fortunes of the Combine.

The Japanese

seem to be again buying a good deal of steamship tonnage. Amongst other vessels I notice that they have taken over three vessels hitherto under the management of Messrs. Rayden's, of Liverpool. These are the :—

	Built	*Place*	*Builders*	*Gross Tonnage*
INDRANI	1894	Barrow	Naval Construction Co.	4994
INDRAWADI	1902	Glasgow	C. Connell & Co.	5194
INDRA	1897	Glasgow	C. Connell & Co.	6957

The last named is a ship with a history. In August, 1900, she went ashore on the African coast near Cape Guardafui, and for some time looked hopeless. The Somalis, who inhabit the coast where she lay, took possession of the vessel and looted her. But eventually they were driven off, and the vessel was floated and taken to Aden, where she was temporarily repaired. In 1901 she was towed home by the steam-tug *Cruiser,* and thoroughly repaired, being restored to her class at Lloyd's.

A very serious disaster has befallen the fine modern passenger steamship *Yongola* of Port Adelaide. She was a single screw vessel of 3664 tons gross register, specially built for the trade in which she was employed by Messrs. Armstrong Mitchell & Co., of Newcastle. She had accommodation for 110 saloon and 144 second-class passengers. She left Townsville for Mackay during the latter part of March with about 68 passengers, chiefly through travellers who had come in by the Orient mail steamship *Otway.* Failing to arrive at her port of destination, considerable anxiety was aroused, as the weather was reported to have been "cyclonic." But all doubt as to her fate was soon dispersed by the discovery of wreckage which undoubtedly came from her, and it was evident that she had struck on the dreaded Barrier Reef and gone to pieces, with the loss of all on board. Her crew numbered some seventy persons, so that altogether not far short of 140 lives were lost in the disaster.

Messrs. Vickers, Limited,

as the great Barrow firm now styles itself, after the retirement of Sir Hiram Maxim, has not found its energies checked by the change which has taken place in its management. It has entered into a formal contract with the authorities of the Harbour of Montreal whereby it will construct important naval works at that port. It has secured a suitable site of some thirty acres on which it intends to erect workshops and a fitting out or repairing basin as well as a floating dock of a capacity to take vessels up to 27,000 tons displacement. About £600,000 is to be spent on the works, and on that sum the authorities have guaranteed a return of 3½ per cent. Possibly the naval ambitions of Canada have something to do with the inception of these works. But they will have an important bearing on the working of the great steamship lines which trade to the St. Lawrence, for the absence of such facilities as are now in course of provision has in the past caused serious delay and heavy losses to British shipowners whose vessels have got into trouble in these waters.

The Harrison Line

of Liverpool, is a progressive and important Company with a foreseeing management. Considerable interest will therefore be aroused by its new departure in starting a monthly service from the Mersey through the Straits of Magellan to California and British Columbia. It should be explained that though Liverpool, as usual, will be the main port of the service, the vessels which maintain it are to commence loading at Antwerp, then proceed to Glasgow and finally touch at Swansea, whence an important export of tin plates has been arranged. After leaving the last-named port a voyage of fourteen thousand miles without a stop is scheduled to San Pedro, and thereafter calls will be made in the important canning industry of the Pacific slope, and much of the return cargo will be canned fruit for the Liverpool market. The trade for which the Harrison line is now bidding has hitherto been in the hands of tramps and sailing vessels, and no doubt the advent of regular liners will be appreciated. The first sailing was made by the *Centurion,* built in 1908 by Messrs. C. Connell & Co., of Glasgow. She left Liverpool on the 15th April. She will be followed by the *Candidate,* also a comparatively new steamship, having been built in the year 1906 at Glasgow by the same firm. For the Harrison line is wise, and opens new trades with modern tonnage, following in the respect the example of that great Liverpool shipowner, the late Mr. T. H. Ismay, who in the seventies made his venture into Pacific waters with a brand new Atlantic liner, and opened his Australian trade many years later, with an entire new fleet of the most modern steamships of a size, at that time, far beyond anything plying to those waters.

Wireless Telegraphy.

Canada is now following the example of Italy, Austria, and the United States and making the installation of "wireless" compulsory upon all passenger steamers, whether registered in Canada or not, which touch at its ports, if they carry a total of passengers and crew combined of fifty persons, provided the ports between which they ply are more than two hundred miles apart. Our Southern and South African Dominions are rapidly providing themselves with land installations—New Zealand, for example, will soon have no less than five—and it would appear that in a very few years no important route will be out of continual touch with the rest of the world.

The London and South-Western Railway

has been one of the last of the important channel steamship lines to adopt the turbine system on propulsion. For they have only now received delivery of the last of the pair of such vessels which have been built for them by Messrs. Cammell Laird & Co., of Birkenhead. But the experience which they have acquired with the first of these sisters has so impressed them with the value of the system that they have already ordered another couple of steamers of the same class. This time the Fairfield yard has the order. The new vessels will be of exceptional interest because they will be the first vessels to be originally fitted with geared turbines. True the cargo vessel, *Vespasian,* has shown her value over a long series of practical experiment. But she is an old vessel and was merely adapted for the trial. But she has satisfied all concerned of one thing, viz., that the wear and tear of the gearing is almost a negligible quantity, whilst she has also shewn that the system will give several advantages over the arrangement now in use, including important economy of coal. In the paper which was read at the Institute of Naval Architects meetings the other day, Mr. Parsons dwelt on the advantages which gearing would give, especially to torpedo boat destroyers. But the South-Western Railway, under the advice of Mr. Biles, have anticipated all Naval authorities and made the first adaptation of the arrangement to fast steamships. The two new sisters are intended for the service between Southampton and Havre, hitherto worked by the sisters *Alma* and *Columbia.*

The Preussen.

The Admiralty Division had a difficult question to decide in the suit brought by the owners of the great German sailing vessel *Preussen* against the Brighton Railway Company, as owners of the turbine steamer *Brighton.* The two vessels were in collision off Newhaven one hazy night last November, and both were damaged. The steamer had her decks swept of funnel and upper works by the sailer's bowsprit, whilst the *Preussen* had that spar damaged and her head sails thereby rendered useless. She also sustained some slight damage forward to her hull. But this was all above the waterline, though she in fact made water in her fore peak. The *Brighton* put back to Newhaven and thereupon a tug the *Albert* came out to offer the *Preussen* assistance, as did the *Brighton's* sister the mail steamer *France.* Both these offers were declined, and the sailing ship ran up channel before the wind, which increased in strength as she went. She attempted to anchor in the East Bay at Dungeness, but lost both anchors, and so perforce had to go on. Then at last she took the assistance of tugs—foreign tugs—and a pilot. The attempt was then made to get her into the

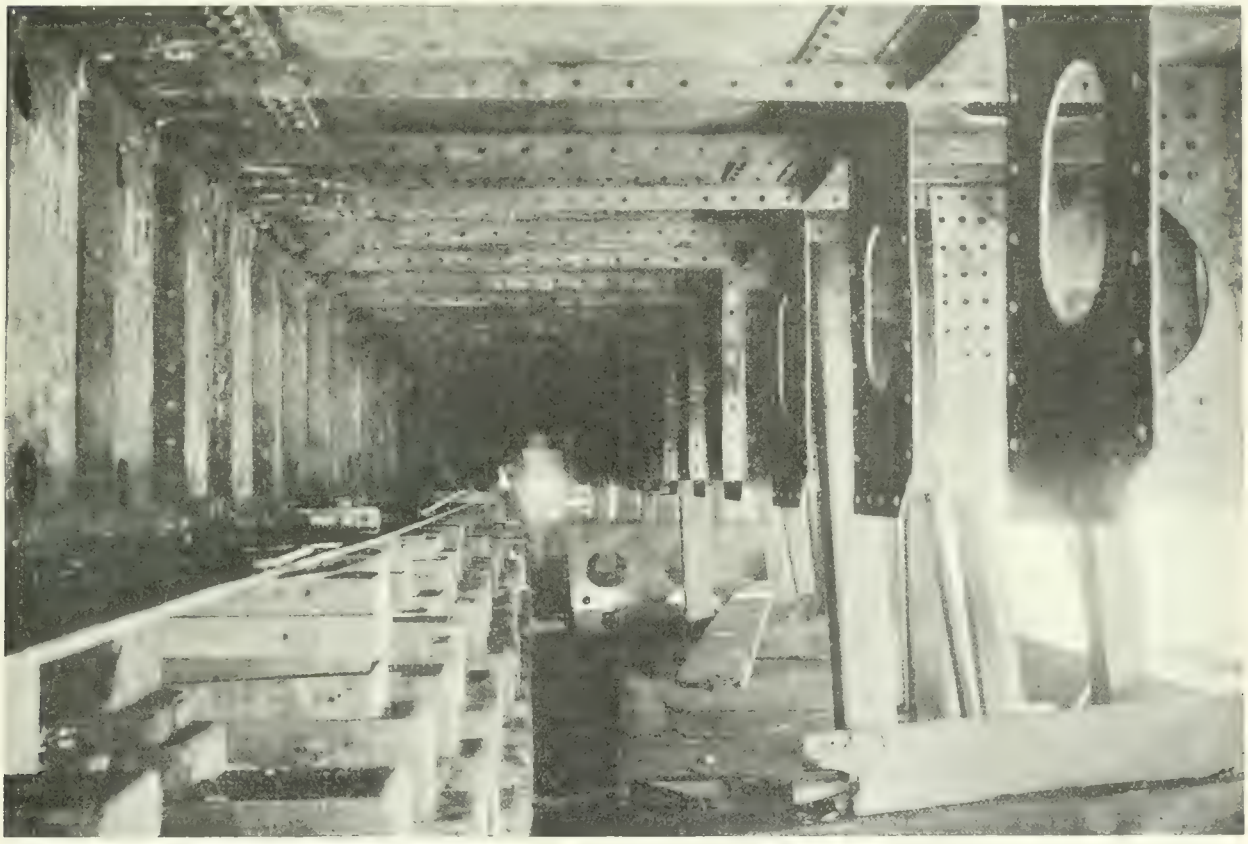
mis-called (at least in this case) harbour of refuge at Dover. But the gale caught the ship on the broadside, as she was exposed to the peculiar currents of the place, and she went ashore, becoming a total loss. The Court was called upon to decide whether—as the *Brighton* people contended, the steamer was responsible only for the damage actually done in the collision or whether, as the German shipowner insisted, the actual loss of the vessel was due to the default of the *Brighton*. In spite of the number of steps between the collision and the stranding, Mr. Justice Bargrave Deane—after considering his judgment for some five weeks—came to the conclusion that the *Brighton* was liable for the whole damage. If this decision is sustained it will shew how comparatively small incidents may land shipowners in exceedingly heavy damages.

and four keel plates were renewed and the balance removed, faired, and replaced or faired in place. These jobs were completely finished after being properly tested and cemented on 23rd February, 1911, but she still remained in dock for repairs to the propelling machinery and refrigerating plants, etc., which were completed on the 3rd and undocked on the 4th March, 1911. She sailed to Kobe on the 7th March.

Herewith we enclose a photo showing the extent of damage.

Before the steamer left the harbour, the representative of the owners wrote us expressing his satisfaction as follows :—

"Before leaving Nagasaki it is my duty to express to the Mitsu Bishi Dockyard and Engine Works my great satisfaction with the very prompt and efficient manner in which the repairs to the s.s. *Papanui* have been executed. I am certain when my friends in Australia see the steamer



S.S. *Papanui* under Repair

(See Correspondence column)

CORRESPONDENCE.

We do not hold ourselves responsible for the opinions expressed by our correspondents.

To the Editor of THE MARINE ENGINEER AND NAVAL ARCHITECT.

Re S.S. "Papanui."

Sirs,—Referring to the s.s. *Papanui* under the heading of "Port Jurisdiction and Solicitude" in *The Marine Engineer and Naval Architect*, No. 401, February, 1911, it occurred to us that it may not be without interest to report that we secured the contract and she sailed from Melbourne on the 5th December, 1910, for Nagasaki, where she arrived on the 4th January, 1911, without any mishap.

The *Papanui* was taken in our dry dock on the 5th January, for the extensive repairs to the bottom damages, the total number of plates dealt with was 136, being 121 shell plates and fifteen keel plates; of this number, fifty-six shell plates

they will be very pleased that they placed the work with your Company.

"I also desire to thank all the members of your staff with whom I have come in contact, from the highest to the lowest, for the great kindness and courtesy which has been extended to me whilst among you."

We are, dear Sir, yours faithfully,

MITSU BISHI DOCKYARD & ENGINE WORKS.
T. SHIOTU,
General Manager.

Nagasaki, 31st March, 1911.

MERCANTILE MARINE BUREAU, JAPAN.—The Director of the Mercantile Marine Bureau in Tokyo has recently issued his annual report for the year 1909-1910, which contains the statistics and statement of the mercantile marine in the Empire of Japan—Formosa and Sakhalin being excluded.

MESSRS. HOLZAPFELS, LTD., have sent us a very long list of vessels coated with their compositions. The period is for the year 1910, and the vessels enumerated represent a total of 15,101,803 tons.

DIESEL ENGINES FOR SEA-GOING VESSELS.*

By J. T. MILTON, Esq., Vice-President.

THE possibility of employing internal combustion engines for the propulsion of large vessels has recently been prominently before those interested in shipping, and as it had been determined to fit several vessels intended to be classed in Lloyd's Register with these engines, the Committee of that Society determined to obtain as much information as possible in regard to their construction and their suitability for the purpose. As the Diesel engine in some of its forms appeared to be that which was making most progress, they asked for and obtained the co-operation of those firms on the Continent who had given special attention to this form of engine for marine work, and visits were made by the Chief Engineer Surveyor and other officers of the Society to each of the firms in question, and much useful information was obtained. The firms were :—Messrs. Burmeister & Wain, of Copenhagen ; the Nederlandsche Fabriek van Werktuig en Spoorweg Materieel, of Amsterdam ; Messrs. Carels Frères, of Ghent ; the Maschinenfabrik Augsburg Nurnberg, of Nurnberg ; Messrs. Sulzer Brothers, of Winterthur ; Société John Cockerill, of Seraing ; and Messrs. Schneider & Cie, of Le Creusot, each of which, besides having considerable experience in the design and manufacture of internal combustion engines, had either completed or had in course of construction some Diesel engines for marine purposes. The British Diesel Engine Company were consulted, and a visit was also paid to Dr. Diesel, with the same object in view. This gentleman and the principals of the above mentioned firms courteously and freely gave full information upon every point upon which their previous work had given them experience.

Since then several British firms have decided to make Diesel marine engines, and as numerous inquiries are being constantly made by those interested in the subject, the present paper has been prepared. It is hoped that the information contained in it, and that brought out in the discussion which will follow, will be of service to shipowners, engineers, and shipbuilders, and will not be without interest to underwriters also.

It need hardly be pointed out that the inducement to forsake the tried and trustworthy servant, the steam engine, for ordinary sea-going vessels will be mainly, if not solely, the question of fuel economy ; but this point, important though it is, would not of itself warrant a change to a new type of engine unless equal certainty of continuous efficiency on the voyages to be undertaken was provided, that is, as little risk of accident to machinery and as great facility for using temporary expedients for reaching port in case of breakdown of part of the machinery. There must also be a prospect of a reasonable cost of upkeep. To each of these points some attention will be given in this paper.

It is evident that, apart from the question of the relative cost and facilities for obtaining supplies of oil fuel and coal, an internal combustion engine using oil possesses many advantages for marine work over one using gas made from coal. Even for land installations the same thing may be said, inasmuch as with oil the comparatively bulky gas producers and scrubbers are not required. There is no trouble with dust in the cylinders, and there should be none with tar on valve faces, etc. Even as fuel for marine steam boilers the advantages of oil over coal are very great. Weight for weight it has at least 50 per cent. higher evaporative efficiency. It occupies less space per ton than coal. It can be carried in double bottoms and other spaces unsuitable for coal or cargo. It requires no trimming, and lessens the number of stokers necessary. Owing to the higher temperature produced and more perfect combustion obtainable, more power can be realised by its use from the same size of boiler. There is greater regularity of power than with coal, owing to there being no fire cleaning necessary. It can be quickly pumped from the stores into the bunkers and the labour and dirt of coaling ship are avoided. Yet with all these advantages oil fuel for ships' boilers is very little used as compared with coal. Leaving war vessels out of account, oil fuel is only used on shipboard in those places where the natural advantages render its use more economical than coal, and by vessels which trade regularly to ports where supplies can be obtained. For the ordinary cargo steamer which has to seek employment all over the globe, coal is still the necessary fuel.

It is said that unlimited quantities of oil are known to exist well distributed throughout the tropical and temperate regions of the world, and that, given a regular and steady demand for it, commercial enterprise will place ample supplies upon the market. Undoubtedly for many years most of the oil raised was for the supply of the refined products, petrol, lamp oil, and to a less extent lubricating oil, the residuum after these had been distilled from the crude oil being a by-product which had either to be thrown away or used as fuel. In these conditions, with a comparatively limited supply of residuum, its price would naturally be determined not by the cost of raising oil, but by the value of the coal with which it had to compete. The market for refined oils, although large, is not unlimited, and it is thought by some that they are at present over-produced. The cost of distillation is a very considerable factor. Considerations of safety render it necessary to use in ships' boiler furnaces only fuel oils having a comparatively high flash point. This practically shuts out from marine boiler use those crude oils which do not contain sufficient of the lighter hydrocarbons to make it profitable to distil them, but which contain sufficient to give them a comparatively low flash point. If the oils are to be used in closed cylinders instead of in ordinary boiler furnaces there is not the same necessity for demanding a high flash point. Experience has shown that even the extremely volatile "petrol" can be safely carried in bulk on board ship.

From the above it may be considered that if internal combustion engines of the oil-burning type become common in sea-going vesels, crude oil, rather than the residues from distillation, will form the major portion of the fuel employed, raised, perhaps, in places where it may be profitable to distil some portion, but it will also be profitable to employ crude oils that are not suitable for distilling.

In regard to this matter it may be well to state here that it is claimed for the Diesel engine that any oil can be used in it which will burn completely, leaving no residue. If this is so, the different qualities of oil must require special experience to know how to adjust the fuel valve to spray them properly, so as to obtain a suitable combustion that will on the one hand consume them sufficiently slowly to prevent an undue rise of pressure, such as occurs in gas and petrol engines, and on the other will permit of their total combustion in the engine. There have, however, been objections taken to this view. Mr. Paul Rieppel, of the Maschinenfabrik Augsburg Nurnberg, of Nurnberg, which has had much experience with internal combustion engines, has made some elaborate investigations on this point, and, after, experiments with many kinds of oils, he has come to the following conclusions :—

The various hydrocarbon oils which occur either as natural products or as the result of distillation either of brown coal, ordinary coal, or crude oils, may be divided into two classes, which differ very much in their behaviour when raised to a high temperature. Those of one class, when raised to such a temperature as is obtained by the compression in Diesel engines, readily decompose into free hydrogen and heavier hydrocarbons, those of the other class at first only vaporise, or partially vaporise, and require much higher temperatures than that due to the compression for their decomposition. In those of the first class the hydrogen, because of its easy ignition, burns first, and the resulting heat enables the remainder of the hydrocarbons to become completely burnt, the total combustion taking an appreciable, though small, amount of time. In the second, a very high temperature is required to initiate combustion, which, when commenced, approximates to an explosion, owing to part of the oil having been made gaseous becoming mixed with the compressed air, and so constituting an explosive mixture. The latter oils, therefore, may be either not

* Read at the Spring Meetings of the Fifty-second Session of the Institution of Naval Architects, April 6, 1911.

properly consumed, or they may be burned with explosive violence.

It should be mentioned that Mr. Rieppel states that even these oils can be used in the Diesel engine by means of special alterations in the design, but it would appear that they could not be used in an engine adjusted for the more suitable oils. In general the oils which are not suitable appear to be the result of distillation of ordinary coal, so that this matter is of more importance to the users of land engines, whilst the oils made from brown coal or from natural crude oils appear to be well suited for Diesel engines.

There is, however, another point which requires attention. Some of the crude oils, and therefore all the residues from their distillation, contain combined sulphur. Some oils are credited with containing as much as 2 per cent. This element, especially at high temperatures, has an affinity for copper, and it has been found that where oil containing sulphur has been used the valves and fittings coming into contact with the oil must not be made of copper or copper alloys. Fortunately, cast iron appears to resist the action of the sulphur, and valves, etc., made of this material have stood well where brass valves have failed. This point shows also the advisability of making all fuel pipes of steel or iron, instead of using copper, unless it is certain that the fuel supply will not contain sulphur.

Whilst dealing with the question of the quality of oil required, it may be advisable to state that extended experience has shown that the requirements of Lloyd's Rules for oil fuel bunkers, etc., have proved their sufficiency for safely dealing with heavy oils suitable for boiler fuel, having a flash point of not less than 150 degrees F. Such oils have been through refineries, and all light hydrocarbons have been distilled from them. Any gas arising from them at even tropical temperature must be very small in quantity and entirely negligible, provision is made for dealing with any possible leakage from any of the oil fuel compartments, and fore and aft peak tanks and double bottoms under cargo holds may be safely used for the fuel. If, however, oils are to be used for engine fuel which have a low flash point, or which give off a perceptible amount of gas, it will be undesirable to carry them in double bottoms under cargo holds, or in spaces from which a leakage would permit of vapours or gas penetrating into cargo holds or other closed spaces where they would be a source of danger.

It must be remembered in this connection that some of the hydrocarbons, creosote, for instance, have a most objectionable and penetrating odour, capable of contaminating and spoiling many kinds of fine cargoes. However, as "petrol" can be safely carried in bulk, suitable provision can be made for any kind of oil to be carried without risk either to the vessel or her cargo.

It may be well to state here what is claimed for the Diesel engine in the way of consumption. In an ordinary steam engine, the power is generally reckoned as indicated horse-power. This is the work performed by the steam on the piston, and is the gross power obtained. It has to overcome the friction of the mechanism, work the slide valves and the pumps, and only about 85 per cent. in round numbers is transmitted to the shaft.

In the Diesel engine the indicated horse-power has similarly to overcome the friction of the mechanism, it has to work the fuel pump, the mechanism for actuating the valves, and to supply the compressed air necessary for injecting the fuel. In the two-stroke cycle also it has to work the scavenging pump. These take up more of the gross power than the accessories do in a steam engine, and hence a less proportion of the gross, or indicated power, is transmitted to the shaft than in a steam engine. For this reason the power of a Diesel engine is more usually expressed as its brake horse-power, that is, the power usefully exerted outside itself.

It is usually claimed that the oil consumption per brake horse-power per hour is 0.4 lb. when the engine is working at full power, and when working at somewhat lower powers the rate of consumption is not much increased.

If one assumes that in a modern steam engine the consumption of coal is 1.25 lbs. per I.H.P. per hour this

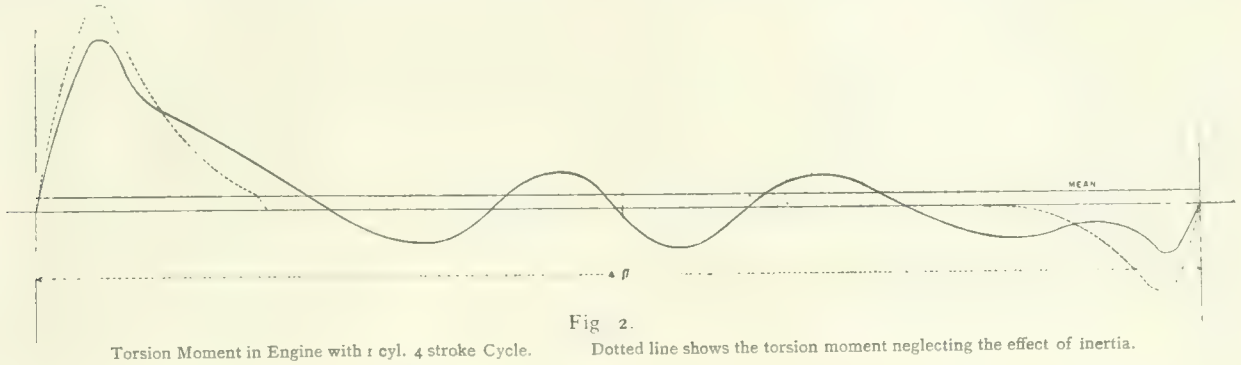


Fig 2.

Torsion Moment in Engine with 1 cyl. 4 stroke Cycle. Dotted line shows the torsion moment neglecting the effect of inertia.

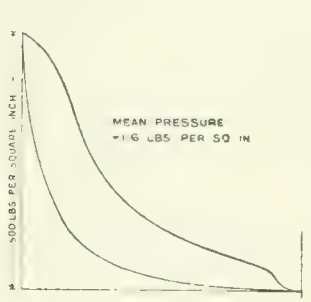


Fig. 1.
Indicator Diagram of Diesel 2 stroke Cycle Engine.

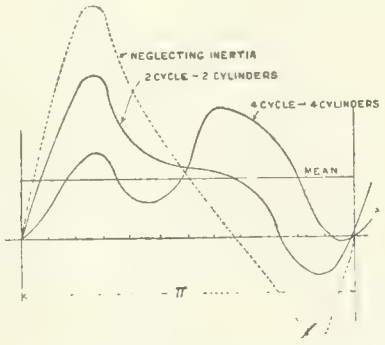


Fig 3
Combined Torsion Moment in 4 cyl. 4 stroke Cycle, and in 2 cyl. 2 stroke Cycle Engine. Dotted line shows the combined moment in either case if inertia is neglected.

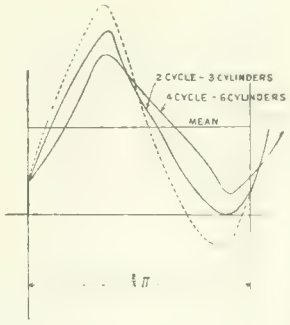


Fig. 4.
Combined Torsion Moment in 6 cyl. 4 stroke Cycle Engine, and in 3 cyl. 2 stroke Cycle Engine.
Dotted line shows the combined moment in either case if inertia is neglected.

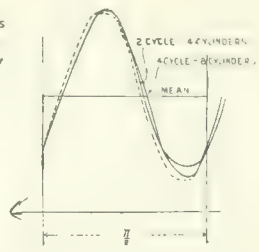


Fig. 5.
Combined Torsion Moment in 8 cyl. 4 stroke Cycle, and in 4 cyl. 2 stroke Cycle Engine.
Dotted line shows the combined moment in either case if inertia is neglected.

corresponds to about 1.47 lbs. per B.H.P., so that the weight of fuel to be carried for the same voyage in a vessel fitted with Diesel engines would be only 28 per cent. of that of the coal necessary with ordinary steam engines.

We will now turn to the engine itself. Its principle of working is generally known. It is made in three forms for marine purposes, *viz.* :—As a four-stroke cycle single-acting engine, a two-stroke cycle single-acting engine, and a two-stroke cycle double-acting engine. An essential feature of these engines is that they require, besides their own cylinders and pistons, an auxiliary air compressor capable of producing a pressure of about 700 lbs. per square inch.

In the four-stroke cycle engine the cylinder cover contains a fuel valve, a compressed air admission valve, one or more ordinary air admission valves, and one or more exhaust valves. All these valves are actuated, that is, opened, by means of cams fixed to a cam shaft, and are kept closed by powerful springs when the cams are out of action. The cam shaft is driven by a two-to-one gear, that is, it makes only one revolution for two revolutions of the engine crank-shaft. Broadly speaking, the cams are so arranged that the air admission valves are open during one whole down stroke, and the exhaust valve during one whole up stroke, but actually a little "lead" is necessary. The cams for the fuel valve and the compressed air valve are so arranged that only one of these can be in operation at a time, so that when either is in use the other is entirely inoperative. In ordinary running the fuel valve is opened at the proper time when the piston is at the top of its travel, and is closed again

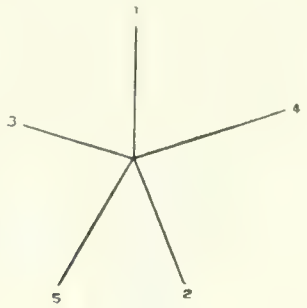


FIG. 6.

when about one-tenth of the downward stroke has been made. The compressed air valve is only used for starting purposes, and it is kept open for a longer period, say, for half or even more of the stroke, its range of opening being made to depend upon the number of cylinders used, so that when these valves are in gear there is no position of the engine in which there is not at least one of them open.

In starting the engine these valves are put into gear, and the fuel valves are, consequently, put out of action. When the engine has made one or more complete cycles, the compressed air valves are put out of gear, the fuel valves commence their work, and the engine then continues its motion, working under "fuel" conditions. As the air admission valve gear is in full action during the starting operations, the full compression would have to be overcome in each cylinder in turn, if it were not for a special arrangement made to relieve part of the pressure in order to facilitate starting. This is put out of action when the fuel admission is put into gear.

Commencing with a piston at the top of the cylinder, the four-stroke cycle is as follows :—

First Downstroke.—The ordinary air admission valve is opened during the whole stroke, and the cylinder becomes filled with atmospheric air at the ordinary atmospheric pressure.

Second Stroke.—The air valve is closed, and the piston returns to the top of the cylinder, compressing the air which has been drawn in during the previous stroke. The clearance is so proportioned that in ordinary working at full speed the pressure becomes about 500 lbs. per square inch, and the temperature is at the same time very much raised. The compression is not quite adiabatic, as the cold cylinder walls must abstract a little of the heat from the air. If it were truly adiabatic the temperature of the air would be raised from, say, 60 degrees F. to 1000 degrees F.

During this stroke a quantity of fuel has been pumped by the fuel pump into an annular space round the fuel valve. When the piston is at the top of the stroke the fuel valve is raised, and at the same time cold air from the air-compressor reservoir at a pressure of 700 lbs. per square inch blows the fuel into the cylinder, which contains hot air, at a pressure of 500 lbs. per square inch. The construction of the fuel valve is such that the oil is "pulverised" or "atomised," that is, it is divided up into a spray of very fine particles. These, upon coming into the very hot air in the cylinder, ignite, and the heat produced by the combustion increases the volume or the pressure of the air. When the adjustment of the valve is correct, the admission of the fuel and the combustion proceed at such a rate that they are almost completed during the time taken for the piston to travel one-tenth of its stroke, and during this period the pressure of 500 lbs. per square inch in maintained.

Third Stroke.—The third stroke of the cycle commences with the combustion of the fuel as mentioned above, after which, during the remainder of the stroke, the hot gases in the cylinder expand until the end of the stroke is reached.

Fourth Stroke.—The return of the piston constitutes the fourth stroke, and during this time the exhaust valves are open, and the burnt gases are expelled from the cylinder. After this the cycle commences afresh.

In the two-stroke cycle single-acting engine, the cylinder covers are similarly fitted with fuel valves and compressed air valves for starting purposes, but the ordinary air inlet valves and exhaust valves are replaced by scavenge air valves. All these valves are actuated by cams ; the cam shaft, however, in these engines rotates at the same speed as the main engine shaft.

The pistons are made somewhat deeper than the total length of stroke. At the lower end of the part of the cylinder barrel uncovered by the movement of the piston, there are numerous ports leading into the exhaust passage. These ports have a vertical dimension of about one-seventh stroke.

The two-stroke cycle is as follows :—

First Stroke.—When the piston is at the bottom of the stroke the cylinder is full of pure air at atmospheric pressure, which air has just been admitted through the scavenge valve. During the up stroke the air is compressed up to 500 lbs. pressure per square inch, precisely as in the compression stroke of the four-stroke cycle engine.

Second Stroke.—The second stroke commences at the top centre by the admission of fuel sprayed in by compressed air precisely as in the previously described engine, and the stroke proceeds in exactly the same way until the piston has travelled about six-sevenths of the stroke. At this point it commences to uncover the exhaust ports through the cylinder sides. So much of the hot gases escape through these ports as to reduce the pressure in the cylinder to about that of the atmosphere. The scavenge valves are then opened and fresh air under pressure is admitted into the cylinder, blowing out the remainder of the burnt gases into the exhaust passages. With these gases, some of the scavenge air also passes into the exhaust. By the time the piston has reached the bottom of its stroke the scavenge valves are closed, but the cylinder is left full of clean air ready for the compression stroke to commence.

There are different arrangements made by different makers for supplying the scavenge air. In some designs each main cylinder has its own air-compressing arrangement and receiver. In other designs sometimes one and sometimes two air pumps are provided, sometimes worked by cranks from the crank-shaft, and in some cases by levers similar to the method of working air pumps in ordinary marine steam engines.

There are also different methods of applying the scavenge air, one allowing it to enter through special valves in the cylinder cover, another by admitting it at one side of the bottom of the cylinder through ports uncovered by

the piston in the same way as the exhaust ports are uncovered. In this latter case the scavenge ports are on one side and the exhaust ports on the other.

The volume of the scavenge air pumps is considerably greater than that of the cylinders, the proportion being in general not less than 1.8. This is necessary to ensure that all the burnt gases are swept out of the cylinder. As the full quantity of air dealt with by the pump must pass from the reservoir into the cylinders every revolution, the pressure to which the air in the reservoir attains depends upon the scavenge valve openings. When these are large a less pressure is required to force the air through them than when they are small. Hence the larger the openings of these valves the less load there is thrown on the scavenge air pump.

In some designs the scavenge air pressure is as much as 7 to 8 lbs. per square inch, in others it is as low as 3 to 4 lbs. above the atmosphere.

In the preceding engines the pistons are of the trunk form. In the double-acting two-stroke cycle engine they are necessarily made of box form, and are fitted with piston rods, which, as they pass through the burning gases at the lower side of piston have to be specially cooled. The pistons also, in general, have to be cooled by either oil or water circulation.

Water is the best cooling medium, as its specific heat is about three or four times that of oil, but some prefer oil as any leakage from the water circulation washes off the lubrication of any of the rubbing parts which it touches.

tested by hydraulic pressure to 120 atmospheres. A safety valve is provided loaded to 60 atmospheres. The compression of the air is attended by the deposition of moisture from it, so that means of draining the steel bottles should be provided.

Naturally there are advantages and disadvantages with each type of engine, and a judicious consideration of these should determine which is the more suitable type to use in any particular case. The two-stroke double-acting engine will be higher than a single-acting one with the same diameters of cylinders and stroke, but the power will be obtained with a less number of cylinders. On the other hand, there is considerably more complexity in the valve arrangements, and a probability of difficulty with piston rod stuffing boxes, to say nothing of the trouble of cooling the pistons and rods by water or oil circulation. There is also likely to be considerable difficulty owing to want of access for overhauling. It should be stated that no experience has been had, as yet, with large engines of this type.

Comparing single-acting engines of the two-stroke and four-stroke types, the former requires only half the number of cylinders which are requisite in the latter, either to produce the same power or the same degree of uniformity of turning moment. The four stroke therefore means a longer engine and necessarily a heavier one also. The valve gear of the two-stroke engine being actuated by a shaft with the same rotational speed as the crank shaft is simpler than that in a four-stroke engine, and the reversing arrangements are much less complicated. The

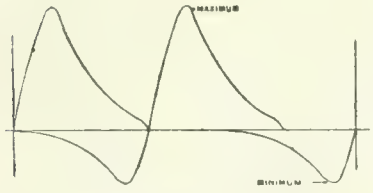


Fig 7
Torsion Moment on 2nd length of crankshaft of a 5 cyl. Engine

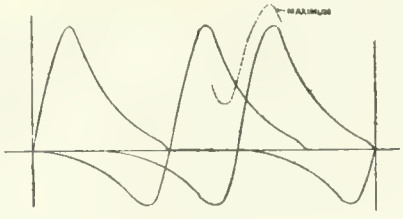


Fig. 8
Torsion Moment on the 3rd length of crankshaft of a 5 cyl. Engine

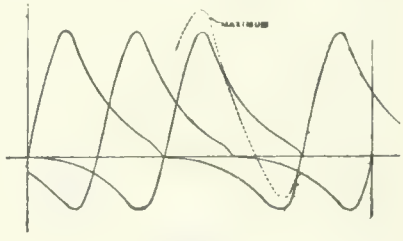


Fig 9
Torsion Moment on the 4th length of crankshaft of a 5 cyl. Engine.

The admission fuel valves, etc., are designed for both the top and bottom of the cylinder. The exhaust ports are in the middle of the length of the cylinders, and the pistons, as in the single-acting engines, uncover the ports at nearly the end of the stroke.

In small engines of the single-acting type the pistons are not water or oil cooled, as it is found they may be kept at a sufficiently low temperature by their contact with the cylinder sides which are water cooled. A heated piston is not so objectionable as it is in ordinary gas or oil engine with timed ignition, as in the Diesel engine pre-ignition cannot occur. The main objections are that with a large piston overheating of the crown may be the cause of structural weakness, and that the expansion of the metal by its high temperature renders it necessary to make the piston crown initially smaller than the cylinder bore.

This has to be arranged in all engines, and the exact amount of allowance is one of those points in which experience is the only guide. It may be said here that this is a matter of extreme importance in those engines in which there are no piston rods. This will be again referred to further on.

Experiments are being made in the case of an engine with a large diameter of cylinder to ascertain whether it is practicable to run it without special piston cooling.

In all the types of engines highly compressed air is needed for starting purposes, and also for the fuel injection. This has to be supplied by an air-compressing plant worked by the main engine. The compression is sometimes performed in two stages, although a three-stage arrangement is generally used. The compressed air is cooled at each stage. The volume of the compressor is such as to provide a small surplus each revolution over that required for the fuel admission in continuous working. This surplus is stored in a reservoir constructed usually as a battery of seamless steel bottles. These are

two-stroke, however, requires the addition of the scavenge arrangements which are absent from the four-stroke, and the necessity for supplying the energy for working these makes the mechanical efficiency less. On the question of efficiency, however, it may be urged that the four-stroke engine has to overcome the friction of the piston, etc., for what may be called two idle strokes out of every four, and this must, to some extent, counterbalance the energy necessary to work the scavenging pumps. In the four-stroke engine all the hot used gases have to escape past the exhaust valves, which thus may become abnormally heated. On the other hand, in the two-stroke engine, they have to pass the bars between the exhaust ports, and it is thought by some that although these parts of the cylinder are water-jacketed, they must become overheated and lose their accuracy of surface, and it must be remembered that all the piston-rings have to pass these bars every stroke. Extended experience will be required to settle all these points. It may be mentioned that an engine is being made on the four-stroke system in which the major portion of the exhaust passes out of the cylinder through ports precisely as in the case of the two-stroke engine, leaving only a part of the burnt gases to be pushed out of the cylinder through the ordinary exhaust valves.

It is instructive to carefully examine the indicator diagram of a Diesel engine and to compare its compression and expansion lines with adiabatic curves

When it is remembered that the circulating water abstracts about one-fourth of the total heat of combustion of the fuel, it will be seen that adiabatic conditions must be widely departed from.

At the commencement of the compression the air temperature will not be very different from that of the atmosphere, and the air will no doubt receive some heat from the cylinder walls. During the compression, after its temperature rises above that of the cylinder walls, some

heat must be given up so that the pressure will not quite reach that due to adiabatic compression.

During expansion, when its temperature is so very high, it must impart a very considerable amount of heat to the cylinder walls, so that after combustion is complete its temperature, and therefore its pressure, must fall below that due to adiabatic expansion. The fact that during nearly all the expansion the pressure is above that of the adiabatic curve shows that combustion must be taking place almost throughout the stroke, and to such an extent as to supply more heat to the gases than is being abstracted by the cylinder sides. It is necessary for complete combustion to take place in order to prevent the fouling of the cylinders by the accumulation of carbonaceous or tarry residues, and it is this necessity for completion of the combustion, which may be termed slow compared with the more rapid burning of the major part of the fuel admitted, which limits the amount of fuel usable per stroke. It can readily be understood that the physical condition of the pulverisation of the fuel is of the greatest importance. If the spraying is not fine enough the combustion will not be sufficiently rapid, whilst if it is too fine it may be so fast as to raise the pressure above the 500 lbs. per square inch which should be the maximum obtained. It would thus appear that different adjustments of the fuel valve will be required with different qualities of oil, which may vary in their chemical composition and also in their viscosity. Further, the conditions also will to some extent depend upon the speed of the engines.

In small cylinders only one fuel valve is employed. It is placed centrally. In very large cylinders it is thought that more than one must be used in order to provide for a more uniform distribution of the fuel into the compressed air, but the conditions determining the number actually necessary are matters which can only be ascertained by experience.

From the results obtained with a Carels Diesel engine in some tests made by Professor H. Ade Clark, of Ghent, which were published in *Engineering*, August 7, 1903, it appears that the total amount of air used per stroke was 3.31 times that theoretically necessary for the complete combustion of the fuel. This shows that the limiting quantity of fuel which can be consumed in the engine depends not so much upon the oxygen supply as upon the time element, and, as above indicated, must be considerably influenced by the physical conditions of the spraying.

The large amount of air used must have a considerable influence in lessening the temperatures obtained by the combustion, but these would be almost the same whether the dilution was with clean air or whether some small part of it was composed of already burned gases. With an admixture of burned gases, such as is always present, for instance, in an unscavenged gas or petrol engine, the combustion would probably be somewhat slower; but it is worth investigation whether under certain conditions which of themselves necessitate slower running of an engine, complete combustion, and the consequent prevention of fouling of the cylinders, would not be obtained in cases where a less than normal oxygen supply was obtainable. This point will be again referred to later on. It may be noticed that in a four-stroke cycle engine there is always a small proportion of burned air present in the charge, as the clearance space must be left full at the end of the exhaust stroke.

In dealing with large powers it is not to be wondered at that there are different ideas amongst engineers who have had experience with Diesel engines as to the best course to adopt, *viz.*, whether to use a large number of small cylinders or a less number of larger ones. For land engines, where very heavy fly-wheels can be adopted, the conditions are altogether different from those obtaining on board ship, and one, two, three, or any number of cylinders, can be employed, according to the choice of the builders, provided the fly-wheels are made sufficiently heavy to give the steadiness of motion requisite. On board ship, however, fly-wheels are not desirable, and very heavy ones are altogether out of the question, owing to the slowness of manœuvring they involve.

In determining the number of cylinders requisite in any given case it will be well to examine the torsion moment diagrams.

It will be seen from the indicator diagrams that when working at full power the forward pressure starts at 500 lbs. per square inch, and at the end of the expansion it falls to less than one-tenth of this amount; the back pressure similarly varies from atmospheric pressure at the commencement of the return stroke to about 500 lbs. at its termination. These conditions are altogether different from anything occurring in a steam engine. The effect of the inertia of the reciprocating parts, however, is considerable at full speed, lessening the maximum load upon the crank pin at the commencement of the forward stroke and augmenting it towards the end, so as to tend to give a more uniform distribution of load throughout the stroke, and similarly during the compression stroke the inertia effect also tends to uniformity.

As, however, in starting the engine the motion has necessarily to commence at a low speed at which the inertia effect is negligible, it is desirable to examine the torsion moment diagrams with the inertia neglected as well as when under full power working conditions. The figures showing the moments under normal working conditions are reproduced from some kindly supplied by Messrs. Sulzer Brothers. Upon some of them have been drawn in dotted lines the conditions which apply upon starting without allowing for the inertia.

In the four-cycle engine it will be seen that with one cylinder only the torsion moment varies from thirteen times the mean effective moment in a positive direction to nearly four times the mean in a negative, a total fluctuation of about seventeen times the mean.

When four cylinders are used Fig. 3 shows that the torsion moment varies from about two and a quarter times the mean moment to one-tenth of the mean moment in a negative direction, the total range of stress being 2.3 times the mean. In the corresponding two-cylinder two-stroke cycle engine the range is greater, being from a maximum of 2.8 to a minimum of — .68 times, or approximately three and a half times the mean stress. The figure shows that in this case the four-stroke cycle engine will work more smoothly than the other.

Considering the four-stroke cycle engine with six cylinders, which is the smallest number of cylinders likely to be proposed with this type of engine, and the corresponding two-stroke cycle engine with three cylinders, Fig. 4 shows that in the former the stress varies from 1.85 to .25, a range of 1.6 times the mean, and in the latter from 2.1 to zero. The advantage again is in favour of the former.

Comparing a four-stroke engine with eight cylinders with a two-stroke single-acting with four cylinders, and a double-acting engine with two cylinders, we see from Fig. 5 that all three engines have about equal variations of torsion moment, the range being from 1.75 to .37 in each case. With these numbers of cylinders the motion approximates in uniformity to that obtained with a steam engine with two cranks.

If we similarly examine the diagrams of a four-stroke cycle engine with twelve cylinders, a two-stroke with six cylinders, and a double-acting with three, we find in all three engines a fairly uniform torsion moment, the ratio of maximum to mean being not greater than 1.15, which is less than is usually obtained in an ordinary triple-expansion steam engine. It may fairly be said that with these numbers of cylinders there is nothing further to be desired regarding steadiness of motion.

In deciding upon the number of cylinders to employ in any case considerations of the turning moments point to a minimum of six cylinders with the four-stroke cycle, of three cylinders with the two-stroke cycle, and that the larger number of cylinders employed the smoother and better the engines will work. Against this, however, is the fact that the larger the number of cylinders the greater will be the number of moving parts, and the more the attention required. More space will be demanded for the engine, which will also become more costly. With the larger number of cylinders, however, in general, owing to the more evenly distributed stresses, the smaller will be the size required for the shafting for the same power.

When very large powers are required, the question will arise as to the upper limit of size of cylinder permissible. On this point there is no actual experience. It is stated

that there need be no limits of size other than those demanded for strength considerations. With larger cylinders, however, it is thought that multiple fuel admission valves will have to be employed. In general it is thought that for very large powers it will be advisable to use more than one line of shafting, keeping the sizes and numbers of cylinders on each shaft within reasonable limits.

One point in connection with the number of cylinders is the question of handiness for manœuvring. The engines have to be started with compressed air, and when they have commenced to move the air arrangement has to be put out of action, and the fuel supply put into gear. In the six-cylinder engines of the *Vulcanus* the starting arrangements have been sub-divided, so that the change over can be first made with three cylinders, whilst the other three are still working with compressed air, after which the change can be made with the remainder. The experience of the readiness of handling which this method provides is so satisfactory, that it will be repeated in some larger engines being made by the same firm.

Another point in connection with the best number of cylinders to employ in any particular case arises when consideration is given to the possibility of working the engines in the event of the breakdown of one of the cylinders, connecting rods, etc.

In a steam engine many casualties may occur in which one cylinder only is disabled, and the engine can still be worked by the remaining two without a serious loss of power or speed, each of the remaining pistons getting a higher pressure upon them than when working under normal conditions. In the Diesel engine, under similar conditions, one cylinder may be disabled, and the others will still be able to work at their full pressure ; the loss of work then will be less in proportion to the number of cylinders employed.

It may be here mentioned that in the four-stroke cycle engines actually made, or in process of building, for large ships, either six or eight cylinders are being used per shaft. In the two-stroke cycle single-acting engines four cylinders seem to be preferred, whilst the double-acting engines being built have three cylinders. Both five and six cylinders have been proposed for the two-stroke cycle.

In a steam vessel, besides the main propelling machinery, there are a number of auxiliaries, all worked by steam. It remains to be considered what would be the best way to provide for doing their work in a vessel fitted with Diesel propelling machinery.

The more important are the following :—

(1) Steering gear.
(2) Whistle.
(3) Donkey pumps for bilge and fire service.
(4) Electric light machinery.
(5) Distillers.
(6) Steam heating apparatus.
(7) Water ballast pump.
(8) Winches.
(9) Windlass.
(10) Ventilating apparatus in passenger vessels.

Of these, the first six and the last are always required at sea, the remainder are generally only needed when the vessel is either in or near port.

Probably for these latter the best solution is to continue the present practice of working them by steam from a donkey boiler, which may be fired with oil fuel. This boiler can be put into action only when in or about to enter port. For the remainder there are some alternatives.

The electric light machinery presents no difficulty, as it can be worked by a small oil engine of either Diesel or other type, using the same kind of fuel as the main engine, resulting in a similar economy of fuel as will be obtained with the main engine.

This engine might also be used for working the pumps for bilge and fire purposes, as these pumps are only required on emergencies when part of the electric light may be dispensed with. The ventilating arrangement can be electrically driven, the motive power being the same engine as is used for electric light. The ballast pump may be a steam pump worked from the donkey boiler, but it may be dealt with by working it by means of a small separate oil engine. There remain the steering gear, whistle, distiller, and heating appliances.

The alternatives proposed are :—

(1) Having a donkey boiler separately fired by oil fuel continuously at work at sea for all these purposes.

(2) Utilising the heat of the exhaust gases by passing them through an auxiliary boiler, and raising sufficient steam for the purpose.

(3) Working the steering gear and whistle by compressed air from the first stage of the compressor, which would be made larger for this purpose.

The second alternative has much to recommend it in view of the great quantity of heat which passes off with the exhaust gases. According to Professor A. Clark's tests previously mentioned, nearly one-third of the total heat of combustion passes off in this way. In the four-stroke cycle engine these gases have a temperature of about 700 degrees Fahr., and are, therefore, capable of giving a good useful effect in a boiler. In the two-stroke cycle, however, owing to the dilution of the hot gases with the excess of the scavenging air, the temperature will be much less, and will probably be not greater than 400 degrees Fahr.

Besides these auxiliaries the Diesel engine requires some of its own. The quantity of circulating water required to keep the cylinder cool is very large. This is probably best supplied by a pump worked from the main engines, but in view of a possible derangement of this pump it will be desirable to have also a separate connection with the ballast pump. The air compressors for supplying the compressed air used for injecting the fuel will also be worked by the main engine, but a supplementary compressor will be necessary to keep up the supply of air which is used in manœuvring. This must be worked by a separate engine.

Further, in the event of the receivers losing the air pressure from any cause, it is necessary to have another small engine which may be started without compressed air (say, a small paraffin engine), in order to obtain a sufficiency of compressed air, preferably in a small separate reservoir, to start the auxiliary compressor engine.

The size of the auxiliary compressor demands attention. Where an ample volume of reservoir is provided a comparatively small compressor is sufficient, as it can be kept working continuously, whilst the demand for air for manœuvring is intermittent. If, however, it is desired to consider it as a provision against a breakdown of the main compressor it must be made nearly as large as the main. The quantity of air delivered through the fuel valve depends upon the time the valve is open, and as the proportion of this to the time taken for a revolution of the engine is fixed, it follows that each cylinder will use about the same quantity of air per minute irrespective of the number of revolutions ; that is, the air supply required will be the same whether the engine is running fast or slowly. If, therefore, a small auxiliary compressor is used for the main engines, the only way to keep up the pressure necessary to inject the fuel will be to shut off some of the main cylinders entirely, working only with a similar proportion of the whole to that which the capacity of the auxiliary compressor bears to that of the main compressor.

As a security against breakdown of the main compressor, therefore, it would appear that it is advisable to have it designed so that all working parts are easily accessible, and to provide a spare piece for each part which is likely to become deranged.

With regard to the upkeep of the engines much can be said. Up till recently these engines have been designed to meet conditions of service on land differing very considerably from those at sea. On land it rarely happens that the engines are worked continuously day after day without stopping, and still more rarely without a weekly stop. These give opportunities for cleaning and for small adjustments. At sea they are required to work continuously. The present marine steam engine is the result of many years' experience and evolution, and if the Diesel engine is to be successful at sea it must be made in accordance with marine engine practice wherever possible.

On land it is customary to have the connecting rod working on a gudgeon secured inside the trunk piston. The piston itself serves as a guide. Marine engineers are accustomed to have the gudgeon exposed to view, its

adjustment can then be quickly and accurately accomplished, and it can be ascertained at every stroke whether its lubrication is satisfactory.

In a double-acting steam engine the alternate thrust and pull of the connecting rod always tend to keep the guide surfaces in contact ; that is, the load on the guide is always one way, and if there is any slack there is no blow and noise. In a Diesel single-acting engine the impulse on the down stroke and the compression on the up stroke requires the guides to be on opposite sides ; hence, if there is the least slack due to wear in the guides, there is a knock both at top and bottom of the stroke. This, for an engine to run continuously, necessitates adjustable guides. The net result is that the gudgeon should be outside the piston, and should have separate adjustable guides, as in an ordinary steam engine. In other words, a piston should be used as a piston only, and should not fulfil the dual functions of piston and guide.

In land engines it is a satisfactory arrangement to have the guides bored out to cylindrical surfaces, which can be made axially true with the cylinders. This would not be satisfactory for long in a marine engine, as, owing to the wear and possibly to the yielding of the thrust, the crank shaft gradually works forward. If the guide surfaces are plane, a little wear of this kind does not give trouble. Too much attention cannot be given to the lubrication of the pistons in the cylinders. In the steam engine practically none is required, but in the Diesel engine it is necessary that the whole of the rubbing surfaces should be well lubricated. The lubrication is forced, and the arrangement should be such that, for each part requiring it, the oil supply, drop by drop, should be visible so as to render it positively certain that no deficiency is occurring. It is desirable also that the water circulation of each part should be controllable.

In marine engines built crank shafts have almost entirely superseded solid ones, and marine engineers are not likely to go back from their use. This will necessitate the strokes of Diesel engines being made longer, in proportion to the diameters of the cylinders, than is usual in land practice.

Much more consideration will have to be given to the accessibility of every working part than has been done in some designs. Every part of the engine which requires periodical inspection or occasional adjustment must be made easily accessible. Provision must be made for the possibility of renewing the crank shaft without lifting the engines out of the ship.

In short, the Diesel marine engine should be Diesel only as regards the cylinders and their accessories, and should be of the ordinary marine type as regards all the rest of the engine.

In some designs of two-stroke cycle engine each cylinder has been arranged with its separate scavenge pump. In other designs one large double-acting pump supplies all the cylinders. In the former arrangement, if one cylinder fails from any cause the remainder are not interfered with, and if a scavenge pump valve gives out, only the one cylinder which the pump serves will be disabled. Where, however, one large pump serves all the cylinders, while it is recognised that the arrangement of the pump with one piston and one mechanically worked valve is very simple and most unlikely to get out of order, yet it must be admitted that its failure, if it does occur, will occasion a complete stoppage of the engine.

Possibly in recognition of this, some recent designs provide for two independent scavenge pumps, both requiring to be in use under normal working conditions. It is improbable that both can be damaged at one time, and seeing that the air supply in each cylinder contains three times the quantity of oxygen chemically necessary for the complete combustion of the fuel, it is expected that in the event of one pump only being at work there will be sufficient air supplied to either work all the cylinders with a reduced fuel supply, or to work, say, three out of four of the cylinders at nearly full power.

It will not be out of place to discuss rules for determining suitable sizes of shafts for Diesel engines. In a steam engine it is usual to consider only the steam pressure cylinder diameters, and stroke as affecting them. In other words, the shafts are proportioned to the torsion moment only, and the bending moment which has to be borne by the crank shaft is ignored, or, at most, is only indirectly allowed for by considering it to be proportional to the torsion moment. In a Diesel engine, however, the bending moment is the more important of the two, and demands to be taken into account.

It is not difficult to ascertain the torsion moment with precision, but the case is different in regard to the bending moment. Where a shaft is supported on two bearings only, it is usual to consider the bending moment it sustains at any part to be equal to that which would be borne by a girder supported at the bearings and loaded at the position of the crank pin. This assumes that there is no bending moment at the bearings, and that the greatest bending comes upon the crank pin. Where, however, the crank shaft is supported at several bearings, the actual bending moments upon it depend upon the distribution of the supporting forces between the several bearings. It is generally considered that as regards bending moments the shaft is under the condition of a continuous girder, fixed in position, not merely supported, at each bearing. This assumption involves a bending moment at the bearings about equal in intensity, although of opposite direction, to that at the crank pin. If the load on the crank pin is assumed to be concentrated at its centre, and the points of fixity of the bearings are at the centres of the journals, then the greatest bending moment upon a crank shaft will be given by

$M_b = \frac{1}{8}$th load × length between centres of bearings.

This is the amount of the bending moment, which has been taken in the following calculations. It is not put forward as being absolutely correct, but it is considered that it is sufficiently accurate to enable it to be used as a basis of comparison of the stresses in similar engines.

If the bending moment only were considered, then in engines of various proportions, assuming the same initial pressure and fuel supply, a rule $d \propto \sqrt{D^2 L}$ would be suitable. If we consider torsion moments only, the rule would be $d \propto \sqrt[3]{D^2 S}$ where

d = diameter of crank shaft.
D = diameter of cylinder.
S = stroke of piston.
L = space between centres of bearings.

As, however, both moments must be considered, it can be shown that a suitable rule can be made of the form

$$d = \sqrt[3]{D^2 (A \times S + B \times L)}.$$

where A and B are co-efficients whose proportion to one another depends upon the relative magnitudes of the bending and torsion moments, and whose actual amounts depend upon the working factor of stress deemed to be suitable.

In the comparisons which will be made it is assumed that it is desirable to have the same margin of security in the shafts of marine Diesel engines as experience has shown to be necessary in those of marine steam engines. For these latter the rules of Lloyd's Register have been taken as fixing a minimum size.

In determining the load which is actually exerted at any moment upon the crank pin, reference is made to the indicator diagram which shows the pressure exerted on the piston. Allowance then has to be made for the effect of the inertia of the reciprocating parts and for the obliquity of the connecting rod.

The effect of the inertia is to render the actual load on the crank pin less than that on the piston during the first part and greater during the latter part of the stroke. The amount of this difference between piston and crank pin loads is negligible when the engines are running slowly, but is considerable with high speeds. At about the middle of the stroke there is no difference at any speed, and as it is at this part of the stroke that the leverage of the crank is greatest, it is found that the inertia effect is not so important when dealing with torsion moments as it is when bending moments are concerned, seeing that the latter do not depend upon the angular position of the crank at all.

As regards the rotatory motion of the engine as a whole, where there are two cranks at right angles, if the reciprocating weights upon each are equal, the effect of the inertia on one crank almost exactly balances that on the other, so that the estimated combined torsion moment has the same value, whether the effect of inertia is taken into account or not. If there are three cranks equally spaced at 120° apart and equally loaded, the combined effect of inertia is also very small, although not quite so small as with two cranks.

TABLE I.

Showing the Values of the various Maximum Torsion, Bending, and Combined Moments coming upon the Crank Shafts of Diesel Engines, the product of Piston Load and Stroke being taken as 1·00, and Inertia being neglected. The space between centres of Bearings is taken as 1·2 times the Stroke. These data refer to an Engine with mean effective pressure of 116 lbs. per square inch.

Number of Cylinders	Tunnel Shaft Torsion Moment.		Crank Shaft under Full Load.			Crank Shaft allowing for Power absorbed by Compressors.			Maximum Torsion Moment on Tunnel Shaft, allowing for Power absorbed by Compressors.
	Maximum	Mean	Max. Torsion Moment	Bending Moment at the Instant of Max. Torsion.	Equivalent Max. Moment estimated as Bending.	Max. Torsion Moment.	Bending Moment at the Instant of Max. Torsion.	Equivalent Max. Moment estimated as Bending.	
1	·300	·037	·300	·124	·254	·296	·124	·252	·296
2	·300	·074	·300	·124	·254	·293	·124	·250	·293
3	·261	·111	·300	·124	·254	·288	·124	·247	·250
4	·261	·148	·330	·124	·272	·315	·124	·263	·246
5	·250	·185	·354	·124	·287	·336	·124	·276	·232
6	·261	·222	·362	·124	·292	·340	·124	·278	·239
8	·320	·296	·420	·124	·328	·390	·124	·309	·291

TABLE II.

Showing the Values of the various Maximum Torsion, Bending, and Combined Moments coming upon the Crank Shafts of Diesel Engines, the product of Piston Load and Stroke being taken as 1·00, and Inertia being neglected. The space between centres of Bearings is taken as 1·2 times the Stroke. These data refer to an Engine with mean effective pressure of 94 lbs. per square inch.

Number of Cylinders.	Tunnel Shaft Torsion Moment.		Crank Shaft under Full Load.			Crank Shaft allowing for Power absorbed by Compressors.			Maximum Torsion Moment on Tunnel Shaft, allowing for Power absorbed by Compressors.
	Maximum	Mean	Max. Torsion Moment.	Bending Moment at the Instant of Max. Torsion.	Equivalent Max. Moment estimated as Bending.	Max. Torsion Moment.	Bending Moment at the Instant of Max. Torsion.	Equivalent Max. Moment estimated as Bending.	
1	·262	·033	·262	·124	·232	·259	·124	·230	·259
2	·262	·065	·262	·124	·232	·255	·124	·228	·256
3	·228	·097	·262	·124	·232	·252	·124	·226	·218
4	·228	·129	·288	·124	·247	·275	·124	·239	·215
5	·219	·162	·309	·124	·260	·293	·124	·250	·203
6	·228	·194	·317	·124	·265	·298	·124	·253	·211
8	·280	·259	·367	·124	·295	·341	·124	·279	·254

TABLE III.

MEAN RESULTS OBTAINED FROM TABLES I. AND II.

Number of Cylinders	Tunnel Shaft Torsion Moment.		Crank Shaft under Full Load.			Crank Shaft allowing for Power absorbed by Compressors.			Maximum Torsion Moment on Tunnel Shaft, allowing for Power absorbed by Compressors.
	Maximum.	Mean	Max. Torsion Moment.	Bending Moment at the Instant of Max. Torsion.	Equivalent Max. Moment estimated as Bending.	Max. Torsion Moment.	Bending Moment at the Instant of Max. Torsion.	Equivalent Max. Moment estimated as Bending.	
1	·281	·035	·281	·124	·243	·278	·124	·241	·278
2	·281	·070	·281	·124	·243	·274	·124	·239	·275
3	·245	·104	·281	·124	·243	·270	·124	·237	·234
4	·245	·139	·309	·124	·260	·295	·124	·251	·231
5	·235	·174	·332	·124	·274	·315	·124	·263	·218
6	·245	·208	·340	·124	·279	·319	·124	·266	·225
8	·300	·278	·394	·124	·312	·366	·124	·284	·273

With four cranks equally spaced the effect is that of two pairs at right angles, and is therefore also negligible. In general where several cylinders are employed, the combined torsion moment will show the same result whether the inertia is included or not.

Seeing that all engines have to be started and stopped, and that from the time they are started they have to progress through all ranges of speed from very slow up to full speed, it is necessary in their design to consider all the conditions under which they work. From what has been said, it is clear that if we neglect the inertia and provide for the conditions at starting, those occurring at full speed will be less onerous, and will therefore also be fully met.

In the comparisons of Diesel engine shafts with those of steam engines, the inertia effect has therefore not been taken into account in either case, it being considered that by taking the most severe conditions in both cases a proper comparison will result.

For the Diesel engines with varying numbers of cylinders the particulars of piston loads taken are from data kindly supplied by Messrs. Sulzer Brothers relating to a marine engine made by them to work on the two-stroke cycle, single acting. The indicator diagram is an actual one taken while full power was being developed. The initial pressure is 500 lbs. per square inch, the mean forward pressure is 171·5 lbs. per square inch, the mean pressure during compression is 55·5 lbs. per square inch. These figures give a mean effective pressure of 116 lbs. per square inch.

Fig. 1 shows the indicator diagram.

Fig. 2 shows the torsion moment which would occur at every position of the crank throughout one revolution in an engine with one cylinder only.

This diagram is important, as being the basis of a series of diagrams which were obtained by superimposing diagrams like Fig. 2 upon one another with the starting points in the positions appropriate to the positions of the cranks.

This series included the cases of two, three, four, five, six, and eight cylinders respectively, and from them the results given in Tables I., II., and III have been obtained. When the whole of the cylinders are thus taken account of the combined diagrams give only the torsion moments on the shafting abaft the aftermost crank pin, and thus apply only to the aftermost journal of the crank shaft and to the thrust, tunnel and screw shafting.

To determine the torsion moments on the other journals of the crank shaft a similar procedure has been taken. As an example of the method the case of a five-crank engine is illustrated in Figs. 7, 8, and 9.

If we consider the forward crank shaft first, it is seen at once that this part of the crank shaft is precisely in the condition of the shaft of a single-cylinder engine as shown in Fig. 2. The conditions of the other crank shafts will depend upon the sequence in which the cranks are arranged. It is probable that the arrangement which will best meet the requirements of this kind of engine is that shown in Fig. 6, the figures denoting the numbers of the separate cranks counting from forwards In this arrangement each crank is as nearly as possible opposite to its next neighbours.

With this arrangement Fig. 7 shows the torsion moment on the aft journal of the second length of crank shaft. Fig. 8 that on the similar journal of the third length, and Fig. 9 that on the fourth. From Fig. 7 is seen that in the second length the maximum positive and negative torsion moments are the same in amounts as in the first length of shaft. Fig. 8 shows that on the third length there is a maximum torsion 18 per cent. greater than that on the first shaft, but there is a less negative moment. Fig. 9 shows that on the fourth shaft there is the same maximum tension as on the third, with a slightly greater negative moment.

The figures given in the tables show that, whereas a progressive increase in the number of cylinders from 1 to 5 actually decreases the maximum stress on the tunnel and screw shafts, each increase in the number of cylinders above three produces an increase of the stress upon the crank shaft.

It is seen from Fig. 2 that the maximum torsion moment is three-tenths of the product of the piston load and the stroke. In Table I. the values of the torsion and other moments are given in this proportion, the product of the piston load and stroke being taken as unity.

When the bending moment is considered, it is found that the greatest intensity does not occur at the same instant as the maximum torsion stress. If we consider the case of an engine with the distance between the centres of bearings equal to 1·2 times the stroke, the maximum bending moment, which occurs when the crank is on the centre, will be ·15 × load × stroke. The bending moment, however, which has to be considered is that which occurs at the same instant as the greatest torsion moment, and it is only ·825 times that of the maximum amount.

In determining the effects of the torsion and bending moments combined, the usual formula has been taken, *viz.* :—

$$M_c = \cdot 35\ M_b + \cdot 65\ \sqrt{M_b^2 + M_t^2}.$$

where

M_c is the combined moment estimated as a bending moment.

M_b is the actual bending moment.

M_t is the actual torsion moment occurring at the same instant.

The values obtained for M_c are given in the tables. They will enable the size of the crank shaft to be determined, provided a definite value for the intensity of stress is agreed upon.

A similar set of calculations has been made, using diagrams obtained when working at ordinary full power in an engine made by another maker. These diagrams do not show so large an amount of power as those previously referred to, but, as they represent good practice, the values obtained from them have been given in Table II.

It has been thought desirable to use the mean of the two results to compare with the mean of results obtained from marine engines. The mean results have been stated in Table III.

In the Diesel engine a considerable amount of compressed air has to be provided for the injection of the fuel, and in the case of the two-stroke cycle engine the scavenge air also has to be compressed. The power required for these operations is usually obtained from the forward end of the crank shaft, but sometimes the various compressors are worked by levers actuated by the motion of one of the pistons. Where the power is obtained from the forward end of the crank shaft, the arrangement lessens the torsion moment upon all the shafting by an amount equal to that absorbed by the compressor. If it is assumed that 10 per cent. of the gross power is used in this way, and that the compressors are so designed as to use a fairly consistent torsion moment, the resulting effects on the shafts of the various engines are included in Tables I., II. and III.

In order to determine a proper value of the intensity of stress to be used for crank shafts for marine Diesel engines so as to preserve the same factor of security as that which obtains with the shafts of steam engines doing similar work, the particulars of seventeen engines by eleven different makers of repute were taken ; these are given in Table IV. The torsion moment diagrams have been calculated for three of the engines, *viz.* :—Nos. 3, 7 and 11, and in these cases the ratios of maximum to mean stress were found to be 1·24, 1·28, and 1·265, giving an average value of 1·262. This has been assumed to be a reasonable value to take in the calculations of all the engines.

From the diagrams which were made, it was apparent that, if the sum of the torsion moments of the high pressure and intermediate pressure only were considered, their combined effect had at no instant a maximum greater than the maximum of the combined moment of the three engines. In other words, the maximum of the two engines does not occur near the points where the low-pressure moment is negative. It was also found that, even allowing for the somewhat greater load, which, in two cases out of the three, came upon the intermediate pressure piston than upon the low-pressure piston, the effect of the combined bending and torsion moment upon the intermediate crank shaft always fell short of the combined effect on the low-pressure crank shaft. In the case of steam engines, therefore, the aftermost crank shaft is somewhat more stressed than either of the others, and it is, therefore, this shaft only which has been dealt with.

(To be continued.)

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(*From our Own Correspondent.*)

Four Months' Clyde Output.—The output of new shipping on the Clyde for the first quarter of the year amounted to over 126,700 tons, and by the end of April this will in all likelihood be augmented by a monthly output much higher than the average. The total for the four months will not fall far, if anything, below the 180,000 tons of the corresponding period of 1907, which was a record figure. The Fairfield Co., Govan, are about to prepare the launching make-up of the 8000-ton liner for the Union Castle Co.'s South African mail service; and a sister ship for that Company is also nearing the same stage in the yard of Messrs. Barclay, Curle & Co., Whiteinch. The following notes refer to the most important of the bookings during April:—

The London and Glasgow Shipbuilding Co., Ltd., Govan, whose launch of the cruiser *Yarmouth* on April 12th is referred to at length, along with an illustration, on another page, are laying the keel and double bottom of a steamer of 400 ft. length to the order of Messrs. T. B. Royden and Co., of the Indra Line, Liverpool.

Messrs. D. & W. Henderson & Co., Partick, have booked an order for a steamer of fully 8000-tons carrying capacity, from Messrs. Maclay & McIntyre, Glasgow.

Messrs. Alex. Stephen & Sons, Ltd., Linthouse, have received from Messrs. Maclay & McIntyre an order for an 8000-ton steamer similar to that above noted as having been ordered from Messrs. Henderson & Co.

Messrs. Lobnitz & Co., Renfrew, are the successful tenderers for the additions to be made to the Clyde Trust dredging plant. The trustees have ordered a powerful bucket dredger at the price of £39,000, and four hopper barges of 1200-tons capacity at the total price of £76,000. Messrs. Lobnitz and Co.'s tenders were the lowest sent in. The Trustees have also agreed to invite tenders for a new twin-screw tug 111 ft. long overall, 23 ft. moulded breadth, and 12 ft. moulded depth. A suggestion to equip the boat with a salvage pump has been reserved for further consideration.

Messrs. Fleming & Ferguson, Paisley, have received an order from the Port of London Authority for two bucket ladder dredgers. With one dredger already completed, and one launched on April 13th, this makes four dredgers which have been ordered from the Paisley firm by the Port of London Authority. The vessel launched on April 13th was the *India*, which is intended to dredge in the Thames, and can work at a depth of 45 ft.

Messrs. John Fullerton & Co., Paisley, have received an order for the construction of a steamer of about 170 ft. in length for New Zealand owners.

Messrs. William Beardmore & Co., Ltd., at Dalmuir Works, are now proceeding with the laying down of the two 8000-ton steamers for the Adelaide Steamship Co., Adelaide, South Australia, the order for which they received in March, and they have recently secured from the same Company the order for a third steamer of similar size and character. The launch from this yard on May 1st of the super-Dreadnought battleship *Conqueror* will be the shipbuilding event of the year on the Clyde. This ponderous ship, which will be named by Lady Pentland, wife of the Secretary for Scotland, will, when complete, have a displacement of 22,500 tons—the heaviest naval vessel yet produced on the Clyde.

Messrs. Murdoch & Murray, Port Glasgow, have contracted to build a steel screw passenger and cargo steamer for service on the Amazon, the machinery for which will be made by a Glasgow firm.

Messrs. Robert Duncan & Co., Port Glasgow, have booked an order from Messrs. W. S. Miller & Co., Glasgow, for a steamer of single-deck type to have a deadweight carrying capacity of 6400 tons. Engines and boilers will be supplied by a Glasgow firm.

Messrs. The Scott Shipbuilding and Engineering Co., of Greenock, are now busy putting the finishing touches to the battleship *Colossus*, which has returned from the South after having successfully undergone all her official trials. Besides the *Ajax*, a battleship of greater size still, the firm have on hand, in a well-advanced state, another item for the Navy of considerable interest. This is the submarine depot ship *Maidstone*, the order for which was placed in August last year, and she is the first vessel of the type to be constructed. She is 360 ft. long by 45 ft. beam, and will provide berthing, victualling and storage accommodation for a flotilla of about sixteen submarines. She is in fact more a submarine floating dock than a ship, as she includes in her equipment foundries and workshops of various kinds, all for repairing the vessels which she is to attend. She will also carry a large number of torpedoes for submarines and specially constructed tanks on board will carry sufficient gasoline to enable the submarines to be recharged without the necessity of their returning to port, thus greatly extending their radius of action.

Messrs. The Greenock and Grangemouth Dockyard Co. are to build in their Grangemouth yard a steamer 230 ft. in length for the carriage of coal in the Australian trade. The vessel, which will be engined by a Glasgow firm, will carry about 2000 tons deadweight on a light draught and will have a speed of 11 knots.

Messrs. George Brown & Co., Ltd., Garvel Shipyard, Greenock, have booked the order for two small coasting steamers for Liverpool owners, the machinery for which will be supplied by Messrs. Gouldie, Gillespie & Co., Glasgow.

Greenock Engine Works Extension.—Scott's Shipbuilding and Engineering Co., Greenock, have under progress and in contemplation extension to their works intended to deal with large boilermaking work, sheet iron work and copper work, a large proportion of which work has hitherto had to be procured from firms outside Greenock. To make room for the necessary extension of works the Company have applied to the Dean of Guild Court for leave to take in portions of two streets adjoining the works on payment to the Corporation of an agreed sum by way of compensation. The total area available is about 57,500 square feet, and it will be entirely covered by buildings constructed of rolled steel framework, having brick and corrugated sheet filling and glass roofing. There will be three bays, each about 450 ft. long, having a span of 50 ft. and equipped with overhead travelling ranes. The height from the ground to the top of crane rails is 30 ft., to the lowest point of roof 38 ft., and to roof apex 50 ft. It is also intended to add a new bay to the existing heavy boilermaking shop on the south side of the Caledonian Railway.

Messrs. The Ailsa Shipbuilding Co., Ltd., Troon, will launch, probably on May 1st, a large steel schooner-rigged racing yacht to be named *Water Witch*. Her lead keel weighs over 100 tons, 86 tons of which were run in in a molten state.

Castings for the Cunard Liner "Aquitania."—Although as yet there is little that is tangible in Clydebank shipyard to evidence the contract Messrs. John Brown & Co. have on hand for the building of the new leviathan Cunard liner *Aquitania*, 50,000 tons register, work on preliminaries is busily proceeding. The important work of manufacturing the cast-steel stern frame, main and smaller propeller-brackets, rudder-frame, etc., has been entrusted to the Darlington Forge Co., Darlington, who were also responsible for the stern frames, brackets, and rudders not only of the *Lusitania* and *Mauretania*, but also of the White Star steamships *Olympic* and *Titanic* now building at Belfast. Although details of the design and dimensions of the castings for the *Aquitania* are not finally settled, it is understood that they will have an aggregate weight of nearly 300 tons, surpassing in size and weight any other marine castings yet manufactured.

The Caledon Shipbuilding Co., Ltd., Dundee, launched on April 12th the screw steamer *Warner*, for the Clyde Shipping Co., Glasgow. This is the second vessel which has left the stocks of the Caledon Co. for the same firm within two months, and the twenty-first built by the Caledon Co. for the same owners.

Motor Cruisers and Yachts form a not inconsiderable portion of the lighter class of shipbuilding and engineering carried out each year on the Clyde, and with the near approach of the season, new pleasure craft are about to be sent afloat. Messrs. Wm. Beardmore & Co., Dalmuir, have in a well-advanced state the oil engines of 120 i.h.p. for the new steel cruiser building from their designs for the Marquis of Graham. Intended for coastal cruising in all weathers, the new vessel, which is 80 ft. on load water line, will carry a crew of six hands. Mr. Wm. Fyfe, of Fairlie, is building

and will shortly launch for his own use a twin-screw yacht of 63 ft. length, which will be driven by two sets of 30 h.p. four-cylinder paraffin engines. At Tarbert, Loch Fyne, a motor cruiser of 43 ft. length, for a Clydeside owner, and one of 53 ft. for owners in the South of England, are in an advanced stage of construction; and at Rosneath on Gareloch a 43-ft. craft of good power for Clydeside owners is almost ready for delivery.

Trawlers and Drifters continue to form the major portion—certainly as regards number—of the vessels launched by North-east Coast of Scotland shipbuilders. Even as far north as Inverness, Fraserburgh etc., steam and motor drifter building has made remarkable progress within less than two years.

The Inverness Steam Drifter Co., Ltd., have already four drifters launched from the Thornbush Quay, while Messrs. John Macdonald & Co., Ltd., launched their fourth vessel from their boatyard opposite Thornbush Quay on April 15th, this vessel being 82 ft. keel and 18 ft. beam. Provost Birnie, at the ceremony of naming the vessel, said the firm were the pioneers of drifter-building in Inverness, and were fortunate in now having the Rose Street Foundry Co., Ltd., to do the engineering work in connection with drifter building.

Messrs. Scott & Yule, Fraserburgh, on April 15th launched a wood steam drifter for Messrs. Meff Bros., fish salesmen, Aberdeen, and Mr. Chas. Brown, fisherman, Cockenzie. The vessel, named *Lizzie Brown*, is 94 ft. in length overall. Triple-expansion engines will be supplied by Messrs. John Lewis & Sons, Aberdeen.

Messrs. Alex. Hall & Co., Aberdeen, also launched, on April 15th, a steam drifter built to the order of Messrs. George Flett & Sons, Findochty, and named *Lizzie Flett*. The dimensions are:—Length, 80 ft.; breadth, 18 ft. 6 in., and depth, 9 ft. 9 in., and she will be fitted with triple-expansion engines supplied by the builders.

Messrs. Hall, Russell & Co., Aberdeen, are at present building a steam trawler for the Admiralty, and an order from the same quarter has recently been placed with the John Duthie Torry Shipbuilding Co., Aberdeen, for two large steam trawl vessels to be used in connection with the new trawler section of the Naval Reserve.

Mr. James Weatherhead, Eyemouth, launched on April 14th a fishing vessel which will be propelled by a crude oil engine to be installed by Messrs. Bolinder & Co., Stockholm. The vessel, named *Bolinder*, is a drifter 82 ft. 9 in. in length, and will be fitted with reversible twin-cylinder engines of 120 b.h.p. working on the two-cycle principle. She will have a speed of 10 miles per hour, the consumption of fuel costing 2s. per hour. The cost of the vessel is £2050.

THE TEES AND HARTLEPOOLS.

(From our Own Correspondent.)

Middlesbrough.

Messrs. Sir Raylton Dixon & Co., Cleveland Dockyard, are reported to have secured an order to build a coaster for Messrs. F. H. Powell & Co., Liverpool, also a small cargo steamer of about 3,200 tons deadweight for Messrs. Furness, Withy & Co., West Hartlepool. They are reported likely to secure an order from Messrs. Elder, Dempster & Co., Liverpool, who have sold the s.s.'s *Port Antonio* and *Port Royal* recently to foreigners.

Messrs. W. Harkess & Co. are fairly busy, and are reported to have booked an order for a small steamer.

Messrs. Richardsons, Westgarth & Co. have booked the order to supply a set of Diesel oil engines of about 1,000 I.H.P. on license from the English Diesel Engine Co., and Messrs. Carels Frères, of Ghent, to be fitted to the cargo boat to be built by Messrs. Sir R. Dixon & Co., Middlesbrough, to the order of Messrs. Furness, Withy & Co., West Hartlepool. They are fairly busy both on marine and land work.

Messrs. Smith's Dry Dock Co., South Bank, are very busy with work on hand in all departments, and are expected to secure an order for some trawlers that are in the market.

Stockton and Thornaby.

Messrs. Richardson, Duck & Co. keep busy with work on hand, but nothing new is reported since last month.

Messrs. Craig, Taylor & Co. have secured an order to build a steamer 380 ft. long, 51 ft. 3 in. beam, through Messrs. S. C. Chambers & Co., Liverpool, for Liverpool owners, on the Isherwood principle. They are also very busy with work on hand.

Messrs. R. Ropner & Son are reported to have secured an order for a cargo steamer for foreign owners.

Messrs. Blair & Co. are now very busy. They are reported to have secured another order, which, with the work on hand, will keep them fully occupied for some months to come.

West Hartlepool.

Messrs. Furness, Withy & Co. have sold the s.s. *Ringwood*, of 900 gross tons, to a firm in Constantinople for about £4,000. The s.s. *Dahome*, recently reported, has been sold to Messrs. Mihran Effendi, Constantinople.

Messrs. W. Gray & Co. are reported to have booked an order for a cargo steamer, and are very busy with work on hand, being well booked up for some months to come.

Messrs. Irvine's Shipbuilding & Dry Dock Co., Harbour Dockyard, have sufficient work on hand to keep them busy all this year, having recently booked an order for two steamers of about 290 ft. long for foreign order.

The Central Marine Engine Works are very busy, having booked the order to supply all the machinery for the ships building by Messrs. W. Gray & Co. They also have a large order on hand for auxiliary machinery for a French firm.

Hartlepool.

Messrs. Richardson, Westgarth & Co., Ltd., have booked the order to supply the engines and boiler for the two cargo steamers to be built by Messrs. Irvine's Shipbuilding Co. at their Harbour Dockyard; also two sets of machinery of about 1,800 I.H.P. for two steamers to be built at the Middleton Yard of the same house. They are also busy in their general and turbine departments.

Messrs. Irvine's Shipbuilding & Dry Dock Co. (Middleton Yard), are very busy, and are reported to have secured the order to build two large cargo steamers for Messrs. Furness Withy & Co., also a small steamer for foreign owners.

THE HUMBER AND DISTRICT.

(From our Own Correspondent.)

HULL, as the third seaport of the United Kingdom, is growing by leaps and bounds. The North-Eastern Railway riverside quay, built outside the Albert Dock Promenade, is a great asset to the railway company; it has cost many thousand pounds to bring it up to its present efficiency. Goods are handled with large hydraulic cranes right into railway trucks and despatched into the Midland districts, and every facility is provided for the passengers. The station is fully equipped and channel steamers arrive and depart any state of the tide. The public of Hull have lost the right of way alongside the river front owing to the attitude of the railway company. The question of the public rights has been taken up and the company has offered to build a promenade 12 ft. wide over the existing warehouses for a distance of between 800 to 900 yards, the cost amounting to about £5000 and to maintain same. Probably the public and Corporation will be better off by accepting the company's terms, and the people will have a better view of the departing and inward steamers on the Humber. The company is now endeavouring to lease land from the Hull Corporation (Western reservation land) to build on and require a twenty years' lease. It would be a great deal better if the Corporation would keep this land and build two graving docks, as these would do the city a great deal of good. The present docks are in the hands of railway companies, hence heavy tariffs, and steamers proceed to Bristol Channel and Tyne ports to use graving docks.

Messrs. Amos & Smith, engineers and boilermakers, Albert Dock Works, are fully employed, having had to increase the night shift. Further orders for boilers and machinery have been booked and the prospects are generally very satisfactory. The outside staff is also fully employed, and the branch shop (Alexandra Dock) is receiving a fair amount of repairing work, also graving-dock employment.

Messrs. Earle's Shipbuilding and Engineering Co., Ltd.—These works are fully employed with repair work, also their patent slips. Lately the company secured an extraordinary share of repairs, some of the repairs amounting to several

thousand pounds. A fair amount of new tonnage is in hand building for local and other owners.

The North-East Coast Engineering Works, Ltd., have had a good month with repair work, and still enquiries are coming in. Work has been effected on the following steamers, *Rosa, Ilderton, Fox, Sterndale, Beeswing, Rhodesian,* and the following tug boats, *Chester, Winchester.* The prospects seem good for the month of May. The firm have also been fortunate in securing a contract for the Corporation tramways department in the boiler and engine-room.

Messrs. Woodall & Co., engineers and boilermakers.—The outside staff of this firm has not been so busy on shipping as in general work, but the works are fully employed with orders for their handy purchase blocks for home and foreign orders.

Messrs. Central Dry Dock and Engineering Co., Ltd., have had a fair amount of work. Their own dock being fully engaged, they have had to engage the H. and B. Railway graving docks on several occasions during the month, putting steamers through Lloyd's survey and several hull damages.

Messrs. Stewart & Craig, engineers and boilermakers, have had extensive repairs on the s.s. *Adalands,* including new decks, after ballast tank repairing, etc., and several English and foreign steamers under general repairs.

Messrs. C. D. Holmes & Co., Ltd., engineers and boilermakers, are keeping very busy, building boilers and machinery for trawlers and drifters building in the district. The engine works and moulding department are at high pressure for their own firm and others. The branch shop at Alexandra Dock seems fairly busy with outside work, repairs, etc.

Messrs. Cooper & Co., Ltd., Neptune Engine Works, are fully employed with outside repair work, and the moulding shop is busy on propeller work for home and foreign orders. The boilermakers are very busy with general repair work. The branch shop at Alexandra Dock is fully employed with graving-dock work, and general repairs to machinery and putting same through for surveys. The Union Dry Dock is engaged with small coasting steamers, overhauling, etc. This firm has several enquiries for May for steamers coming to Hull.

Messrs. Cochrane & Sons, shipbuilders, Selby, are well booked up with orders for trawlers and drifters for local and Grimsby owners, and in many cases cannot give delivery until towards the end of the year.

Messrs. Cook, Welton & Gemmell, shipbuilders, Beverley, are keeping busy building trawlers for local and Grimsby owners, in some cases guarantee of delivery this year is required.

SOUTH OF ENGLAND AND ISLE OF WIGHT.

(*From our Own Correspondent.*)

Messrs. J. I. Thornycroft & Co., Ltd., Woolston Works, Southampton.—H.M.S. *Martin* was delivered into H.M. service last month and H.M.S. *Minstrel* is completing for delivery. The watertight compartments on H.M.S. *Acheron* are under water test, and the *Ariel's* boiler rooms are now water tested. Stern Wheel Passenger Steamer for Persian Gulf.—This vessel was launched in March and ran a satisfactory steam trial just before Easter. Armoured Motor Patrol Boats.—Good progress is being made on the eighteen boats with wooden hulls, and an additional order for four boats in steel, to be in other respects similar to those in wood, has been received from the Turkish Government. Repair Work.—During last month the following vessels were in hand for repair or alterations :—H.M.S.'s *Halcyon, Argus* and *Seahorse,* and steam yachts *Erin* and *Ladye Gipsey.*

Messrs. J. Samuel White & Co., Ltd., East Cowes, I. of W.—H.M.S. *Ruby,* torpedo-boat destroyer, the third vessel of this class completed during the last few months by Messrs. White & Co., was handed over to the Admiralty on the 7th of last month. H.M.S. *Ferret,* of the 1910-11 programme, was launched on the 12th of last month. Work is proceeding on a large number of naval steamboats and other small craft.

Messrs. Day, Summers & Co., Ltd., Northam Ironworks, Southampton.—On Wednesday, the 12th of April, the above firm launched the paddle steamer *Princess Mary* for the Isle of Wight and South of England R.M.S.P. Co., Ltd. After launching the vessel was placed under the firm's sheer legs to receive the engines and boiler. The vessel has been built under the supervision of the Board of Trade and is of the following dimensions :—Length B.P., 195 ft. ; breadth moulded, 24 ft ; depth moulded, 8 ft. 3 in. The engines are of the diagonal type with cylinders 23 in. and 48 in. dia. with a stroke of 51 in., and the boiler is designed for a working pressure of 130 lbs. per square in. The vessel has a fine deck saloon aft, with a ladies' saloon leading out of it, and a dining saloon below the main deck, and forward below the main deck there is a good second-class saloon. The promenade deck extends from the forward end of the stokehold right aft, and is carried out to the full beam of the vessel. The vessel is expected to take up her station before Whitsuntide. The firm have sold the s.y. *Ulna* to Mr. R. T. Jones, who has renamed her *Cresta.*

THAMES.

(*From our Own Correspondent.*)

Shipping Companies.—The Cunard line, so intimately associated with Liverpool, has, by acquiring the passenger and cargo service carried on between London and Canada under the name of the Thomson line, become connected with the Thames. The service will be based on London, and it is presumed that as at present there will be calls at Southampton. It would seem that it may be expected in the future that such vessels as the *Franconia* and *Laconia* will leave the Thames for Montreal. In another direction the Union Castle line to South Africa has appointed Lord Selborne to a seat on the board. The appointment is of some significance in view of the action of the Union Parliament in passing legislation designed to restrict the operations of the South African shipping ring, and especially aimed at the Union Castle Co., which carries the mails. Lord Selborne, from his position with the head of the Government at the Cape, will be a great support to the Company in their dealings with the legislature there. At the annual meeting of the African Steamship Co., Lord Pirrie, who presided, mentioned that it is proposed to apply for a new charter. This Company is old-established and had its origin in a private expedition up the Niger as far back as 1832. The Company received its charter in 1852 with an annual subsidy of £30,000 for a monthly mail passenger and freight service, and has continued in the trade ever since. The dividend for the past year has been 7 per cent. against 5 per cent. The Company has acquired an interest in the Elder line. The Company was under the management of the late Sir Alfred Jones, and is still closely identified with the Elder Dempster line, having Sir Owen Philipps as chairman.

H.M.S. Buzzard.—This vessel, so familiar to passers-by on the Embankment, has by Admiralty order replaced the *President,* formerly berthed in the West India Dock, and will be renamed to that of the earlier vessel and take over her duties under the Admiral commanding coastguards and reserves as from the 1st April. Though the Royal Naval Reserve will not be trained on her the vessel will take over the duties previously assigned to the old *President,* as regards officers and men borne on her books for duties at the Admiralty and other services, but will continue to act as drill ship for Royal Naval Volunteer Reserve, as she has done hitherto. This is the change that was foreshadowed some time since.

Company Report.—The Edwards' Air Pump Syndicate has declared a balance dividend of 10 per cent., making 15 per cent. for the year 1910, and £684 carried forward. Including £943 brought in, profit for the year is £3888. The number of pumps booked during the year was 525, compared with 555 during 1909. The report states that the expiry of some of the Company's patents has affected the income derived from royalties, and it is anticipated this process will continue as time goes on. The directors are considering returning a portion of the capital to the shareholders.

MERSEY AND MANCHESTER SHIP CANAL.

(*From our Own Correspondent.*)

ALL branches of work continue to be very brisk in the Mersey port. Especially is this the case with naval work, mercantile orders have not been so plentiful, although there is a good deal of work in the finishing stages.

Mersey shipbuilders have now in hand fourteen merchant vessels of 20,984 tons gross, compared with 22,110 tons three months ago, and 35,140 tons twelve months ago. In naval work, however, a displacement tonnage of 33,540 tons is in hand; this includes the super-Dreadnought *Audacious*, the colonial cruiser *Melbourne*, the destroyers *Lapwing* and *Lizard*, the two tenders to depôt ship and the four fast destroyers for the Argentine Navy. This, of course, does not include the large floating dock for the British Admiralty.

Messrs. Cammell, Laird & Co.—Extensions and organization are keeping pace with the large programme of work in hand in this immense yard, and at the present time a walk round the various dry and wet docks and works must impress one with the large and varied class of work turned out by this firm. The floating dock is fast revealing its gigantic proportions in the Mud Dock at the south end of the yard, while the battleship and cruiser are also making rapid progress. In the wet basin the stern wheeler *Francisco Galles*, with its two funnels abreast is fast nearing the finishing stage, alongside of which is the *San Luis*, the first of the Argentine destroyers, which it is expected will be ready for trials in about two weeks' time. The last two Argentine destroyers are heavy plated and will shortly be launched, while the two Admiralty tenders are well in plate. Various flat-bottomed barges are under construction. The repair department has been well employed. With the object of centralizing the whole staff, both clerical and technical, Messrs. Cammell, Laird & Co. have recently erected a large and commodious suite of offices at the Tranmere yard, and it is anticipated that increased facilities will be derived due to having the whole staff under one roof.

Messrs. David Rollo & Co.—All departments of this establishment are practically full up just now, and this appears likely to last for some time. The building of ships' cranes is one of the firm's specialities, fourteen of them to lift 3 tons are just now in hand, being made in duplicate and interchangeable. The brass and iron foundries and the erecting and machine shops are also very full. Messrs. Rollo make a speciality of fitting new propellers when better results are required, as much as 1½ knots having been gained in a ship's speed. In the boiler works new boilers are in hand for the *St. Tudno*, also for the City of Dublin's steamer *Louth*, and the Langlands' steamers *Princess Ena* and *Sophia*. The new marine experimental boiler for the Hughes-Harrison Engineering Laboratory at Liverpool University is receiving every attention. This boiler will be fitted with the highest class of mountings, Tod's patent smoke-box doors, of which Messrs. Rollo are the sole makers. H.M.S. *Eagle*, which was recently taken over by the Royal Naval Volunteers, is being altered by this firm under the direction of Sir Richard Williams Bulkeley, the accommodation is being improved and an installation of electric light is being fitted.

Messrs. H. & C. Grayson.—As many as thirty steamers are in hand for repairs at the various yards of this Company, and several instances have recently occurred where work has been secured in open competition from a distance. A speciality is made of quick repairs, thus keeping boats off their run as short a time as possible. The Cardiff-owned steamer *Canganian* was recently towed round from Cardiff to Liverpool, also the *Drumcliffe* from London, the latter with extensive bottom damage.

Messrs. Clover, Clayton & Co.—Work here has been very brisk, amongst other vessels the oil tank steamer *Hycrania* has had extensive overhaul, while the steamers *Brema*, *Busk* and *Gem* have had quick overhaul. The extensive improvements to the yard are making good progress; these include the electrification of the yard, the installation of two 24 in. centrifugal pumps, the deepening of Nos. 1 and 6 docks by about 2 ft. No. 1 dock is completed, while No. 6 will be completed in about two months. These improvements will place the yard in the forefront of the many repair establishments on the river. Mr. Henry E. Nickson has recently retired from the position of works manager to Messrs. Clover, Clayton & Co. after fifty-five years' service. He joined the firm of Messrs. Clover & Royle in Liverpool in 1855, in the days of the wooden vessels, and later was transferred to the Birkenhead works, where he was associated with the building of many famous clippers, also many important salvage feats. Presentations of a rose bowl and a silver tea and coffee set have been made to him.

Messrs. John Holt & Co.—The mosquito-proof steamer *Thomas Holt* has recently returned from West Africa after her second voyage. No case of sickness has occurred on board during this time. Together with her sister ship the *Jonathan Holt*, this vessel was fitted with mosquito-proof doors, windows and ports to the specification of Major Ronald Ross, F.R.S., and this step is only one of the results of the influences due to the Liverpool School of Tropical Medicines.

The Cunard Line.—This Company have arranged to extend their Mediterranean service to the Black Sea. The terminal port has previously been Constantinople, but in future Odessa and Batoum and possibly other ports will be tapped; ore cargoes chiefly will be carried on the homeward voyage. In connection with the acquisition of the Cairn Thompson line, it may be of interest to note that the Cunard connection with Messrs. Swan, Hunter & Wigham Richardson, Ltd., began in 1898 with the purchase of the *Altonia*, and during the past thirteen years nine vessels of 200,000 tons displacement will have passed into the Cunard fleet from this yard. Mr. John Foster, of Bootle, has passed away in his 87th year. He was in the Cunard service for over fifty years.

NORTH-WEST OF ENGLAND.

(*From our Own Correspondent.*)

Barrow.—All is business and activity at the Naval Construction Works of Messrs. Vickers, Sons & Maxim, not only by reason of the unusual programme of work in hand but because of the preliminary arrangements for the launching of the battleship cruiser, *Princess Louise*, for the Admiralty. This vessel, it has been arranged, will be launched by the royal lady whose name she bears. The arrangements for launching are practically complete. The vessel rests on a great cradle mounted on very broad ways, the broadest ever yet used at Barrow. The vessel is in fact the largest ship ever launched at Barrow, and looks indeed a monster. She is not only of immense width but of unusual length. The way ships are launched at Barrow is on a liberal declivity, so that as soon as she is relieved of her last shores she begins to glide into the water at a good speed. She has a good offing in Walney Channel, but she is pulled up by drags as she moves down the slipways and immediately she reaches the water she is pulled up altogether, not only by her drags, but by the heavy anchors which are thrown out. Immediately on this being done the stern of the vessel launched begins to move up channel and the tugs are ready to get hold of her bow and tow her into the docks. There have practically been no accidents at Barrow in the launching of vessels, as there are specially good launching facilities, and the management take care to err on the side of extreme caution so as to prevent any possible accident. The engines (turbines) and boilers for the *Princess Royal* are ready to put on board as soon as she is berthed alongside the 200-ton crane in the Buccleuch Dock. She will then be thronged with an army of workmen connected with all departments of the shipbuilding trade, as the desire and intention of the management is to complete her within the two years agreed upon when the order was placed at Barrow.

The Japanese Cruiser Battleship.—This vessel, which is building alongside the *Princess Royal*, and to which no name has yet officially been given, is making rapid strides in her central construction. Her keel has been laid and her ribs are already asserting themselves well up on her sides. This vessel, about which much secrecy is observed, is supposed to be longer, broader and larger than the *Princess Royal*. She looks an immense length now, and it is expected before she is finished it will be necessary to take down some of the buildings in the yard to make room for her bow. The vessel has to be delivered as quickly as possible, and the black squad, who have been busily employed on the *Princess Royal*, will soon be busy on her.

The Chinese Cruiser.—This small cruiser of the scout class will soon be ready for launching. She is expected to be followed by other orders from the Chinese Admiralty.

Torpedo Boat Destroyer.—A torpedo boat destroyer for the British Admiralty building at the Barrow yard is making rapid progress. She will soon be ready for launching. This vessel is creating great interest as the Vickers' firm have not for many years past built a vessel of this class.

Aberdeen Floating Dock.—This dock, built by the Vickers' Co. for Aberdeen has been launched and is being fitted

up preparatory to her leaving Barrow for her northern home. She will lift a vessel about 300 ft. long.

New Orders.—The past month has been one of surprises in the sense of the magnitude of the orders placed with the Vickers' Co., and as to other orders which are in a fair way of coming to Barrow. This firm is in combination with Armstrong's and Brown's in reference to the two Turkish battleships which have been given out to the Armstrong group. It is understood one of the vessels will be built at Barrow and one at Elswick, that the engines of both ships will be built at Barrow, that the guns will be made by Messrs. Armstrong, and that the armour will be made at Sheffield, probably by Messrs. Brown. In any event the order means much for Barrow, as these ships are to be of the size of H.M.S. *Dominion*. Then again, it is reported that the Vickers' group, with which Messrs. Armstrong are associated, are the lowest tenderers for the two Chilian "Dreadnoughts." They are £200,000 per vessel lower than the American and German firms who tendered. If this order comes off Barrow will build one ship and Messrs. Armstrong the other, and Barrow will build the engines for both ships. Messrs. Vickers during the month have also secured the order for a huge floating dock for Montreal. This dock has to lift 27,000 tons, and will be useful for British war vessels on the Canadian coast.

Messrs. Vickers' Enterprise.—It is known that Messrs. Vickers' are associated with big shipbuilding yards and are likely to be connected with others in foreign countries. They are already associated with Spain, they are making arrangements with Japan, they are talked about as regards Portugal, and they have just completed arrangements with the Canadian Government for a big yard at Montreal.

Iron and Steel.—The iron and steel trades are quiet and lower prices are ruling. Plates are much cheaper than they have been.

Shipping.—There is depression in the shipping trade and there has been for some time a gradual shrinkage in the export tonnage of iron and steel.

BELFAST.

(*From our own Correspondent.*)

Wages.—With further reference to the question of wages in Belfast, fitters, turners, brass-finishers and pattern-makers have been granted an increase of 1s. per week, dating from the first pay in April, 1911, and a further advance of 1s. on the first pay in November, 1911. Machinemen receiving 23s. and over per week get the same rise, and those receiving under 23s. per week have an increase of 6d. now, and 6d. in November. Then, as regards the Black Squad, an advance of 1s. per week has been conceded to angle smiths, platers, riveters, caulkers and holders-up, this taking immediate effect.

Work in Progress.—According to Lloyds' returns for the quarter ending 31st March, the number of vessels under construction on the Lagan is 24, with a gross tonnage of 259,185, against 20 in the corresponding period of last year, with 233,360 gross tonnage.

Messrs. Harland & Wolff.—This firm's yards are fully occupied, and they have at present four steamers fitting out with an aggregate gross tonnage of 77,300. These are the White Star liner *Olympic*, the *Maloja*, the *Demosthenes* and the *Galway Castle*, built for the P. & O., the Aberdeen and the Union-Castle lines respectively. The *Galway Castle* was launched on 12th April, and is a vessel 452 ft. long, 56 ft. beam, and has a gross tonnage of about 8000. She will be fitted with accommodation for a large number of first, second and third class passengers. The *Olympic* was, on 8th April, successfully docked in Belfast's new graving dock, referred to elsewhere. She leaves Belfast on 29th May, and her sister ship, the *Titanic*, is to be launched on 31st May.

Messrs. Workman, Clark & Co. are also fully supplied with orders, all the slips in both yards being occupied. They have several vessels of considerable tonnage at the fitting-out wharves, and the end of the year should find them occupying a position near the top of the tonnage output list.

Harbour Notes.—Regarding the new graving dock, the Harbour Commissioners are to be congratulated upon the exceedingly favourable terms of settlement of the dispute between the contractors, Messrs. Walter Scott & Middleton, and themselves. It may be remembered that during the progress of work at the new dock, there was a disastrous collapse of the outer end of the Alexandra Graving Dock adjoining, and a flooding of, and stoppage of work at, the new dock. For this the Harbour Commissioners claimed that the contractors were liable. The latter denied liability, but after a long period of deadlock it was agreed that the work of restoration should be proceeded with, and the question of liability determined later. To put the matter briefly, in the end the contractors' claims on account of this work and extras on the new dock, including interest, amounted to £150,000, and the parties to the dispute were faced with the prospect of a big law suit, or suits, that would not, in all probability, have been settled out of the House of Lords. After negotiations extending over a considerable period, the matter has been amicably settled, Messrs. Walter Scott and Middleton agreeing to accept the sum of £50,000 in full settlement of all claims.

The Harbour Commissioners have recently taken delivery of a motor pilot launch, which has been built for them by Messrs. John I. Thornycroft & Co., Ltd. The boat is 33 ft. 6 in. long, with a beam of 8 ft., and draught of 2 ft. 3 in. She is fitted with a Thornycroft two-cylinder 15 b.h.p. paraffin motor, and has a roomy cabin with wide seats on either side fitted up to serve as bunks if necessary. The guaranteed speed was 7½ knots, and on trial on the Thames a speed of 8.26 knots was obtained. The little vessel is intended for conveying pilots to and from the pilot schooner which lies down the Lough.

REVIEWS.

Electric Crane Construction. By Claude W. Hill. Charles Griffin & Co., Ltd., London, 25s. nett.

THIS is a volume of some 300 pages of letterpress, and is profusely illustrated by drawings not of the usual manufacturer's catalogue type, but reproductions of working drawings with scale annexed, so that a fairly accurate estimate of sizes and dimensions can be readily obtained. This feature is a distinctly valuable one, for which the author deserves full commendation. It is interesting to note that the subject matter is substantially a compilation of notes and data collected by the author in the execution of his work, and, therefore, the book has more than ordinary value. The first seven chapters deal with the principal types of cranes such as, overhead, locomotive and jib, derrick transporter, sheer legs, revolving cantilevers, and cableways. Each chapter commences with a description of the construction and duty of the crane, and the stresses and other features of the particular type in each case are then dealt with. The following chapters deal in turn with the power required for crane driving, the starting torque and acceleration, the design of crane structures, the design of machinery, brakes, toothed gearing, hooks, lifting magnets, ropes and chains, the design of magnets, electric motors, electric controllers and collectors, and lastly the important subject of crane installations. Having regard to the wide and extending use of electric current, the detailed information as to motor controllers and other electrical apparatus is most useful, while the mechanical problems with regard to running gear carried on a more or less flexible structure are dealt with in a most comprehensive manner. The book fills a useful purpose for engineers dealing with the subject.

The Directory of Shipowners, Shipbuilders and Marine Engineers, 1911. Subscription price 5s., after publication 10s. London. The Directory Publishing Co., Ltd.

THIS directory, in its 9th year of publication, is the most complete and exhaustive book of its kind, and it should be in the possession of all those connected with the industries which its title indicates, and allied trades and professions. The present edition has been thoroughly revised and brought up to date, and some 20 pages have been added. As usual, under the section "Shipowners," the fleets are placed with tonnage, speed, and builders of vessel and engines. Under the section "Shipbuilders and Engineers," the officials' names are given. Other useful sections are the "Boat Index," and the "Personal Index," which contains the names of directors, partners and chief officials of shipowning, shipbuilding and marine engineering firms or companies. The book can be recommended as a very useful one.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Framlington Court.—On March 16th, Messrs. R. & W. Hawthorn Leslie & Co., Ltd., launched from their Hebburn Shipyard a large vessel which they are building to the order of the Court Line of London, of which Messrs. Haldinstein & Co., Ltd., are the managers. The dimensions of the vessel are length 388 ft., breadth 51 ft. 3in., depth moulded 26 ft. 9 in., and she is being built to Lloyd's Highest Class. She will have a deadweight capacity for cargo of about 7,400 tons on a light draught, and the loading and discharging operations should be carried out with rapidity and ease as six large hatchways are provided with a powerful winch to each, working twelve derricks. The capacity of the water ballast tanks is over 1,000 tons. The vessel will have her machinery fitted at Stockton-on-Tees. This is being constructed by Messrs. Blair & Co., Ltd., and consists of a set of Triple Compound direct acting engines with cylinders 26 in., 42 in., and 70 in. in diameter by 48 in. stroke, the steam being supplied by three large single-ended boilers. It is estimated that the vessel will have a speed of 10.11 knots at sea. Messrs. Wailes, Dove & Co.'s "Bitumastic" Enamel was applied to the lower bunkers and tank top in boiler space.

Highland Piper.—On March 18th, this vessel, built to the order of Messrs. H. & W. Nelson, Ltd., for their South American Service, was successfully launched from the Tranmere Shipyard of Messrs. Cammell Laird & Co. The vessel is 414 ft. B.P. by 56 ft. 2 in. beam by 35 ft. 1 in., to the shelter deck, and to class 100 A1 Lloyd's three-deck rule. There are complete orlop, main, upper, and shelter decks of steel, the orlop deck aft forming crown of tunnel. A cellular double bottom runs all fore and aft, the engines are placed amidships and there are three holds forward and two aft. The machinery consists of a single screw set of engines, having cylinders 31 in., 51 in., 56 in., 54 in. stroke, four single-ended boilers 17 ft. 6 in. by 12ft. 0 in. for 12 ft. 0 in. for 210 lbs. working pressure, three of them fitted with Howden's forced draught, the remaining one natural draught, to develop about 4,400 I.H.P., and to drive vessel at a service speed of 13½ knots. No. 3 hold is arranged for carrying coal on the outward journey, the permanent bunkers providing the supply for the return journey, the total being about 3,000 tons. All the holds and 'tween deck spaces both forward and aft of the machinery and bunkers are most completely insulated and equipped with meat rails and hooks and everything necessary for the successful transport of chilled meat. The refrigerating plant, which is one of the most powerful afloat, is placed on the upper deck immediately abaft the engine casing, and the brine tank houses are built between the main hatches on the shelter deck with decks extended out to ship's sides for supporting the steam winches. Square ports are fitted in the shelter 'tween decks in the event of the ship carrying troops or emigrants for whom permanent lavatories are built amidships on this deck. Accommodation for the crew and firemen is arranged forward under the shelter deck and on the deck immediately below for cattlemen and stewards. The estimated gross tonnage of the ship is about 7,500 tons, and the nett about 4,500, the total capacity of holds and 'tween decks, available for the capacity of meat is about 360,000 cubic feet. Very powerful steering gear is placed on the upper deck right aft with telemotor to navigating bridge to the after docking bridge. The passenger accommodation, which is of the most up-to-date description and handsomely decorated throughout, provides for 108 first class and 32 second class. Messrs. Wailes, Dove & Co.'s "Bitumastic" Enamel was applied to bunkers, engine and boiler room tanks and bilge pockets, and their "Bitumastic" Covering to tank tops in boiler room and donkey boiler recess, also deck in refrigerating spaces.

Lissa.—On March 29th, Messrs. Short Bros., Ltd., launched from their shipyard at Pallion, Sunderland, the s.s. *Lissa*, built to the order of Messrs. Glen & Co., for the Scandinavian Shipping Co., Ltd., and of Glasgow. She is a single deck vessel, with cargo poop, and bridge and topgallant forecastle, built to the Isherwood system of longitudinal framing, and will take Lloyd's highest class. Her leading dimensions are: Length 363 ft. 0 in., beam 50 ft. 0 in., and depth moulded 28 ft. 1¾ in., and she is designed to carry a large deadweight on a moderate draught. Cellular double bottom is fitted all fore and aft, and both peaks are arranged for water ballast. Eight steam winches, steam windlass, steam steering gear, fitted in engine room and controlled from standard on flying bridge and connected by steel wires to quadrant aft, with hand steering gear aft, are fitted. Eight derricks are provided to main hatches worked from strong tables on masts, and the cross bunker hatch is worked by two derricks swung from Samson posts, which are also to act as wing ventilators to stokehold. The holds are specially arranged to be as far as possible clear of obstruction to permit of large pieces of machinery being shipped. The propelling machinery will be fitted by Messrs. George Clark, Ltd., of Sunderland, and consists of triple expansion engines, with cylinders 25, 41, 68 inches diameter, and a stroke of 45 inches, taking steam from three large multitubular boilers, working at 180 lbs. pressure, and fitted with Howden's system of forced draught. The model of ship and engines have been designed with a view to economical working, and it is expected that the vessel will readily maintain a sea speed of 10 knots.

Fiume.—On March 29th, Messrs. Richardson, Duck & Co. launched from their shipyard the second of two steel screw steamers which have been ordered on behalf of the "Atlantica" Sea Navigation Co., Ltd., of Budapest, by the Director-General, Hr. Eugen Pollacsek. The vessel is of the following dimensions: Length overall 345 ft. 0 in., length B.P. 331 ft. 0 in., breadth extreme 48 ft. 3 in., depth moulded 24 ft. 6 in. She is capable of carrying about 5,300 tons D.W., on a draught of water of under 21 ft. 0 in. The vessel is of the single deck type, with poop, long bridge and forecastle. The vessel is constructed to Lloyd's rules for their highest class and under special survey. An ample supply of water ballast is carried in double bottom. Steam windlass, steam steering gear, a large number of steam winches, steam heating, and electric lighting are provided. Triple expansion machinery will be fitted by Mesrs. Blair & Co., Ltd. The cylinders will be 24 in., 40 in., 65 in., by 42 in. stroke, and there will be two single ended boilers 15 ft. 6 in. diam., by 10 ft. 6 in. long, working at 180 lb. pressure. Messrs. Wailes, Dove & Co.'s "Bitumastic" Covering was applied to tank tops in boiler room, and their "Bitumastic" Enamel in boiler room tank.

Caresfield.—On March 29th, Messrs. Robert Thompson & Sons, Ltd., launched from their Southwick Yard a finely modelled self-trimming collier, built for Messrs. The Gordon Steam Shipping Co., Ltd., of London. The *Caresfield* is of the raised quarter and well deck type, and built to take the highest class at Lloyd's. Her principal dimensions are: Length B.P. 268 ft., breadth 38 ft. 8 in., depth moulded 18 ft. 8 in., and will carry about 2,620 tons D.W. on a light draught of water. The vessel is fitted with deep bulb angle framing, the holds being left clear of all obstructions, and has been specially designed for the Hamburg trade, having four large hatchways arranged to make her perfectly up to date as a self-trimmer, and to facilitate rapid loading. For discharging the cargo there are eight powerful steam winches with latest improvements, placed on raised platforms, and in addition to the usual derricks there are twelve steel gaffs fitted, the masts being strengthened for this purpose. To enable her to make quick return voyages ample water ballast is provided throughout the cellular double bottom and fore and after peaks, the former being divided longitudinally and athwartships for trimming purposes, and fitted with large tank suction pipes, and extra large ballast donkey for quickly pumping out water ballast. The holds are ceiled with American rock elm. The tank top under boilers, lower and bridge bunkers are coated with patent enamel. The mooring arrangements have also received special attention, for in addition to the large fairloads and bitts steel wire compressers are placed on the poop and forecastle decks. Auxiliary hawse pipes, as well as the usual pipes, in bow chocks are fitted of ample size to take cables when riding in heavy weather. Accommodation for captain and officers is provided in the poop, the saloon being beautifully fitted up in polished mahogany with pilasters of teak. Spacious rooms for the engineers are arranged at the sides of the engine casing under the bridge deck, the

petty officers and the crew being comfortably berthed in the forecastle. At the forward end of the main bridge the steering gear house is erected, with lower flying bridge on top, also large teak charthouse, the latter carrying upper flying bridge and wheelhouse. The engines of the triple expansion type are by Messrs. Blair & Co., Ltd., of Stockton-on-Tees, having cylinders 21 in., 34 in., and 56 in., with a stroke of 36 in., steam being supplied by the two extra large boilers working at 180 lb. pressure. During construction both hull and engines have been under the personal supervision of the owners' superintendent, Mr. W. Gates, of South Shields.

Themis.—On March 30th, Messrs. Wm. Doxford & Sons, Ltd., launched from their yard at Pallion, Sunderland, a large shelter deck vessel, built to the order of Wilh. Wilhelmsen, Esq., of Tonsberg, for whom in January last the firm built the s.s. *Tellus,* a duplicate of the one launched to-day. The dimensions are: Length 461 ft., breadth 60 ft., moulded depth 39¼ ft. The dead weight of 13,000 tons is carried on a moderate draught. Messrs. Doxford have supplied the engines and boilers. The classification is with the British Corporation and Norwegian Veritas; and the vessel has been built under the superintendence of Messrs. C. A. Bushell, Nicol & Co., Newcastle, on behalf of the owners. Messrs. Wailes, Dove & Co.'s "Bitumastic" Enamel was applied to dry tank under boilers and wing ballast tanks, also to the lower side bunkers and cross bunkers.

Bretwalda.—On March 31st there was launched from the yard of the Sunderland Shipbuilding Co., Ltd., a steel screw steamer, 364 ft. 0 in. length between perpendiculars, 50 ft. 8 in. broad, and 26 ft. 8 in. deep, of the single deck type, having poop, bridge, and top-gallant forecastle; classed 100 A1 Lloyd's under special survey, with a deadweight carrying capacity of 6,700 tons upon a light draught of water. Shifting boards are fitted in all holds, and the vessel will comply in every way with the Grain Carrying Act; Board of Trade certificate will be obtained for carrying grain in bulk. A large marine type donkey boiler is supplied for driving the deck machinery, which consists of seven steam winches, steam steering gear, and direct steam windlass having quick warping ends. The main engines are by the North-Eastern Marine Eng. Co., Ltd., Sunderland, and have cylinders 25 in., 42 in., and 68 in., by 45 in. stroke, steam being supplied by two large boilers working at a pressure of 180 lbs. per sq. in. The steamer has been built to the order of Messrs. The Hall Brothers Steamship Co., Ltd., of Newcastle, and during construction has been inspected by Mr. Heslop on behalf of the owners.

Zevenbergen.—On March 31st, Messrs. Irvine's Ship Building and Dry Docks Co., Ltd., launched from their Harbour Dockyard, West Hartlepool, the steel screw steamer, *Zevenbergen,* which was built to the order of the Stoomvaart Maatschappij "Hollandia" of Rotterdam (Mr. J. J. A. Van Meel, director). The dimensions of the vessel are 340 ft. by 47 ft., by 24 ft. 10 in., having a single deck, with poop, bridge, and forecastle, and has been built to Lloyd's highest class. A double bottom is fitted throughout on the cellular principle, and the fore and after peak tanks are arranged as trimming tanks. She is constructed with deep frames and longitudinal stringers, giving clear holds for the stowage of bulky cargoes. Five watertight bulkheads divide the vessel into six watertight compartments; she has extra large cargo hatches, six steam winches, which are supplied with steam from a vertical multitubular donkey boiler, and is replete with all the latest improvements for rapid loading and discharging. A powerful quick-warping steam windlass is fitted forward for the working of the cables, and steam steering gear is fitted amidships with hand screw gear aft. Triple expansion engines are being supplied and fitted by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, having cylinders 23½ in., 38 in., and 64 in., by 42 in. stroke, with two large single-ended boilers working at a pressure of 180 lbs. per square inch.

Langholm.—On March 31st, Messrs. William Gray & Co., Ltd., launched the handsome steel screw steamer *Langholm,* which they have built for The London and Northern Steamship Co., Ltd., Messrs. Pyman Brothers, London, managers. The vessel is of the shelter deck type, and will take the highest class in Lloyd's register. Her dimensions are: Length overall 395 ft. 0 in., breadth 53 ft. 6 in., and depth 25 ft. 5 in. The hull is built with deep bulb-angle frames dispensing with hold beams and leaving large clear holds, cellular double dottom and fore and aft peak ballast tanks, ten steam winches, derrick tables and outriggers, and double derricks, steam steering gear amidships, hand screw gear aft, patent direct steam windlass, large horizontal multitubular donkey boiler, fresh water distiller, steel grain divisions, stockless anchors, telescopic masts, boats on deck overhead, and all requirements for a first-class cargo steamer. Triple expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 25 in., 41 in., and 68 in. diam., with a piston stroke of 48 in., and two large steel boilers for a working pressure of 180 lbs. per square inch.

Kinross.—On April 1st, the Northumberland Shipbuilding Co., Ltd., launched from their yard at Howdon-on-Tyne, the finely moulded steamer, built to the order of Messrs. B. J. Sutherland & Co., Ltd., Newcastle. The vessel is over 375 ft. long by 51 ft. 4½ in. beam, by 28 ft. 4½ in. deep, and has been built under special survey to the highest class at Lloyd's. She is fitted with long bridge, long poop, topgallant forecastle, the accommodation, which is very ample, being placed in steel houses on the bridge deck. This steamer has been specially designed with a view to rapid loading and discharging of homogeneous cargoes, the hatchways being very long and wide, and are arranged for grain carrying in bulk, a complete set of shifting boards being fitted throughout to latest Board of Trade requirements. Ample deck gear is provided, consisting of eight steam winches, by Messrs. Clarke, Chapman & Co., Ltd., Gateshead, and a larger number of cargo derricks to ensure the expeditious handling of cargoes. She is fitted with the usual water ballast arrangements for light passages. The machinery will be supplied by Messrs. The North-Eastern Marine Engineering Co., Ltd., consisting of engines with cylinders 24 in., 41 in., 67 in., by 45 in. stroke, three large steel boilers, with 180 lbs. pressure. This vessel will carry about 7,300 tons on a light draft, and steam about 10 knots loaded at sea.

Exford.—On April 1st, Messrs. Craig, Taylor & Co., Ltd., launched from their Thornaby Shipbuilding Yard, Thornaby-on-Tees, a handsomely modelled single deck screw steamer of the following dimensions, *viz.*: 395 ft. by 50 ft. by 29 ft. moulded. She is built of steel to the highest class in Lloyd's Registry, under special survey, and has poop, bridge, and topgallant forecastle. Water ballast in double bottom fore and aft and in peaks. She is equipped with patent direct steam windlass with quick warping ends, steam steering gear, seven large steam winches, exhausting back to separate condenser in engine room; large multitubular donkey boiler of the marine type. Steel shifting boards in holds for carrying grain cargoes; telescopic masts to Manchester Ship Canal requirements, special hatch and derrick arrangement for rapid loading and discharging. Her engines have been constructed by the North-Eastern Marine Engineering Co., Ltd., Sunderland, the cylinders being 25 in., 42½ in., 69 in., by 48 in., with two large steel boilers working at 180 lbs. pressure, with large evaporator, feed heater, winch condenser, spare tail end shaft, and patent steam ash hoist. The vessel has been built to the order of Messrs. W. J. Tatem & Co., Cardiff, and is the third vessel built by Messrs. Craig, Taylor & Co., Ltd., for the same owners.

LAUNCHES—Scotch.

Seal.—On March 22nd, there was launched from the yard of Messrs. Napier & Miller, Ltd., Old Kilpatrick, the steel screw steamer *Seal,* built to the order of Captain J. A. Farquhar, Halifax, Nova Scotia. The dimensions of the vessel are: Length 175 ft., breadth 26 ft. 6 in., depth 20 ft. 5½ in., with a gross tonnage of about 520 tons, built under the rules of Lloyd's Register for their highest class. The vessel is rigged as a two-masted schooner, has upper and shelter decks, water ballast in double bottom and aft peak, and has been specially strengthened for working in ice when sealing off the Newfoundland coast. The vessel has been fitted with electric light, including a

searchlight, steam windlass, steam steering gear, and two steam winches and wireless telegraphy. The vessel is beautifully fitted and admirably suited from the owner's long experience for cruising in Northern waters. The machinery is being supplied by Messrs. Aitchison, Blair, Ltd., Clydebank, and consists of triple expansion engines and one large main boiler and donkey boiler.

Moacyr.—On March 22nd, there was launched from the yard of Messrs. Murdoch & Murray, Port Glasgow, a steel twin screw cargo and passenger steamer, which they have built for service on the River Amazon, and embodies many new features which do not exist on any previous vessel built for that river, the state-rooms being on an entirely new design ; the saloon is placed in the forward end of the vessel instead of aft, as it usually is. All the accommodation has been specially arranged for lightness and airiness with very large stained glass windows and venetians. The main saloon opens outward on to an extra promenade deck, where is placed the navigating quarters. An illuminated sky sign, showing in colours, is fitted, and the holds have electrical sounders indicating automatically the presence of any water in any of the holds. Two sets of powerful triple expansion engines will be fitted on board by Messrs. Ross & Duncan, Govan. In the machinery department also, there are many special features, including steam ejectors to all the holds.

San Guglielmo.—On March 29th, Messrs. David & William Henderson & Co., Ltd., Meadowside Works, Partick, launched the twin screw passenger steamer *San Guglielmo,* which vessel they have built for Messrs. Peirce Bros., of Naples. The vessel is specially built for the emigrant trade between the Mediterranean and the United States, and is so arranged as to comply with the various requirements of the Italian, American and British Governments with regard to the carriage of emigrants. The *San Guglielmo* is a vessel of 490 ft. in length, 56 ft. 3 in. in breadth, and 36 ft. 3 in. in depth, with a gross tonnage of about 8,500 tons. Splendid accommodation has been provided for 2,000 passengers in all, divided into 1st, 2nd and 3rd class. The first-class accommodation is placed on the promenade deck, and comprises the usual public rooms. The second-class passengers are accommodated on the promenade deck and shelter deck, and here also are provided large and well ventilated public rooms and state-rooms. Accommodation for about 1,800 third-class passengers is provided in the 'tween decks and under the poop. The sanitary arrangements are of the most complete description, and extensive lavatory and bathroom accommodation, etc., has been provided in most suitable positions. Extensive kitchens and bakeries are also fitted for the use of passengers, conveniently placed near the dining rooms. In case of sickness, separate hospitals for males and females have been provided, and in addition, hospitals for infectious diseases have been placed in an isolated position at the after end of the vessel. Ventilation and heating have had special consideration, the emigrants' sleeping quarters, crew's quarters in 'tween decks, hospitals, etc., being ventilated and heated by the Thermotank system of mechanical ventilation. An installation of Marconi Wireless Telegraphy for long distances has been fitted, and the vessel is also lighted throughout with electric light. The machinery of the *San Guglielmo,* which has also been constructed by the builders of the vessel, consists of two sets of triple expansion engines, with cylinders of 25 in., 41 in., and 68¼ in. diameter, with a stroke of 48 in., steam being supplied by six single-ended boilers working at a pressure of 200 lbs. per square inch.

Elephanta.—On March 31st, the twin screw steamer *Elephanta* was launched at Whiteinch. The vessel has been built to the order of the British India Steam Navigation Company, and is intended for their Eastern trade. The dimensions are: Length 413 ft., breadth 52 ft. 6 in., depth 36 ft. to shade deck, and tonnage 5,000 gross. The vessel has been constructed to Lloyd's and Board of Trade highest class. Accommodation is provided for a large number of first and second-class passengers, and the 'tween decks are specially arranged for carrying native passengers.

Riviera.—On April 1st, there was launched at Dumbarton the turbine steamer *Riviera,* built to the order of the South-Eastern and Chatham Railway Company. The vessel is intended for the company's service in the English Channel. She is 315 ft. long, and has a moulded breadth of 41 ft., and a depth of 24 ft. 6 in. to the awning deck. Spacious passenger accommodation is provided for both first and second-class travellers. A feature is the special provision for carrying motor cars.

Warner.—On April 12th, the screw steamer *Warner,* built for the Clyde Shipping Co., Glasgow, was launched by the Caledon Shipbuilding Co., Ltd. This is the twenty-first built by the Caledon Co. for the same owners. She has been built for passenger and cargo trade, and her tonnage is 1,350 tons gross. She is 260 ft. long, 35 ft. 6 in. beam, and 18 ft. 2½ in. depth moulded. The hull has been constructed to the highest class in the British Corporation Registry, and conforms to Board of Trade requirements. The accommodation provided for passengers is of superior character. Four steam cranes are placed adjacent to cargo hatches, which are of large dimension. The propelling machinery, supplied from the Caledon Co.'s Lilybank Engine Works, consists of a set of triple expansion engines, having cylinders 20 in., 33 in., and 53 in., with a stroke of 39 in. Steam is supplied from two large steam boilers, and in addition there is a large donkey boiler for supplying the deck machinery.

Kanna.—On April 14th, Messrs. Ramage & Ferguson, Ltd., launched from their shipyard at Leith the largest steel screw steamer constructed at the port for some years. Built to the order of the Union Steamship Company of New Zealand, whose headquarters are at Dunedin, N.Z., and intended for their general coasting trade. The new steamer has dimensions 272 B.P. by 41 ft. beam by 19 ft. 10 in. moulded, and is built to Lloyd's highest class, with single deck, deep frames, with poop, bridge and topgallant forecastle. The captain and all officers have accommodation on top of bridge amidships, and arrangements for working cargo are of the most complete description, eight steam winches being fitted, while warping winch on poop, steam steering gear, steam windlass are also provided, also an elaborate system of electric lighting throughout the vessel. Triple expansion engines are fitted, having cylinders 21 in., 34 in., and 56 in. diameter, by 36 in. stroke, supplied with steam from two large steel boilers working at 180 lbs. pressure, all suitable for a high rate of speed at sea.

LAUNCH—Irish.

Galway Castle.—On April 12th, the large twin screw steamer, built by Harland & Wolff, Ltd., for the Union-Castle Line, was launched at Belfast. The new steamer is 452 ft. long between perpendiculars, 56 ft. beam, with a gross tonnage of about 8,000. The vessel will be fitted up for a large number of passengers—first, second, and third-class—the accommodation being in the usual high-class style of the Line. She will also have large cargo capacity. She has been built to the requirements of Lloyd's for their highest class, with eight watertight bulkheads extending to the upper deck, and double bottom extending right fore and aft. The arrangements for working ship and cargo will be of the latest and most approved type, and the vessel will have a complete installation of electric light, also refrigerating machinery.

TRIAL TRIPS.

American Transport.—On March 18th, the s.s. *American Transport,* proceeded on her official trial trip in Hartlepool Bay. Owing to the inclement weather it was impossible to attempt a speed trial, and the vessel proceeded to the Bristol Channel to load. See launches, April.

Neleus.—On March 23rd, the new screw steamer *Neleus,* built and engined by Messrs. Workman, Clark & Co., Ltd., Belfast, for Messrs. Alfred Holt & Co., left Belfast Harbour and steamed to Carrick Roads, where, after adjustment of compasses, the machinery tests and speed trials were carried out. These all proved highly satisfactory, and the vessel afterwards proceeded to Swansea to take in coal and part of her cargo, after which she left for Birkenhead to complete loading cargo in preparation for the maiden voyage to The Straits, China, and Japan. See launches, March.

Amicus.—On March 24th, the steel screw steamer *Amicus,* built by Messrs. Craig, Taylor & Co., Ltd., Stockton-on-Tees, to the order of Messrs. The Tempus Shipping Co., Ltd. (Messrs. W. H. Seager & Co., Cardiff, managing

owners), was taken to sea for her loaded trial trip, which proved highly satisfactory. During the trial everything worked with the greatest smoothness, and a speed of 11 knots was maintained, the vessel being fully loaded. See launches, March.

Bra-Kar.—On March 23rd, the Tyne Iron Shipbuilding Co., Ltd., of Willington Quay-on-Tyne, took to sea for her trial trip the s.s. *Bra-Kar,* built for the Fred. Olsen Linie of Christiania. On trial trip she attained a mean speed of over 11¾ knots, which was considered highly satisfactory by the owners' representatives, Mr. Carl Conradi, of Christiania, Captain Fritz Olsen, and Mr. Nichol of Messrs. C. A. Bushell, Nicol & Co. After the trial trip the vessel proceeded direct on her voyage to Christiania. See launches, March.

Crainton.—On March 26th, the new steamer *Crainton,* built by Messrs. Ropner & Sons, Ltd., Stockton-on-Tees, to the order of Messrs. R. Chapman & Son, Newcastle-on-Tyne, made her official trial trip in the Tees Bay, when she maintained a high rate of speed. After a satisfactory trial trip the vessel steamed round to the Tyne. See launches, April.

Coila.—On March 31st, the new steamer *Coila,* which Messrs. Archd. McMillan & Son, Ltd., Dumbarton, have just completed for Liverpool owners, having finished loading, carried out trials on the measured mile at Skelmorlie. The trial proved satisfactory in every way, a mean speed of fully 10½ knots being obtained, and immediately thereafter the vessel sailed on her maiden voyage to Monte Video. See launches, April.

Vosges.—On April 1st, the fine steel screw steamer *Vosges,* built by Sir Raylton Dixon & Co., Ltd., at their Cleveland Dockyard, Middlesbrough, to the order of Messrs. James Moss & Co., of Liverpool, proceeded to sea for her official trials. The trials passed off most successfully, and the vessel returned to the Tees to load, whence she proceeds on her maiden voyage under the command of Captain J. R. Green. See launches, April.

Edenor.—On April 4th, Messrs. Osbourne, Graham & Co., sent to sea for her official trial trip the patent steamer *Edenor,* which they have specially constructed to the order of Messrs. The Edenor Shipping Co., Ltd., of Newcastle-on-Tyne, for whom Messrs. Gronquist Bryan & Co. are managers. The vessel has been built upon the arch principle of construction, to the design of Mr. Maxwell Ballard, the patentee, and is the first vessel to be constructed under the Ayre-Ballard patents. Although the weather was so exceedingly stormy that the vessel was unable to run on the measured mile, everything worked without a hitch of any description during the trial. After the trial the vessel proceeded on her first voyage laden with coal for Calmar, Sweden. See launches, April.

Arna.—On April 6th, the large steel screw steamer *Arna,* built by Messrs. Wm. Gray & Co., Ltd., to the order of Messrs. S. M. Kuhnle & Son, of Bergen, Norway, was taken to sea for her trial trip. After adjustment of compasses, the vessel was put through the usual manœuvres, and although a heavy sea was running at the time, everything worked smoothly and well. On the conclusion of the trial the vessel proceeded on her voyage under the command of Captain Jentoft. See launches, April.

Erdeley.—On April 7th, this vessel, built by Messrs. Palmers Shipbuilding and Iron Co., Ltd., Jarrow, to the order of the Hungarian Levant Steamship Co., Ltd., was taken to sea for her fully loaded trial off the Tyne, when a speed of practically 10½ knots was attained on the measured mile for the six hours continuous run. The trials were witnessed by Mr. V. de Rottauscher, the Austro-Hungarian Consul General. See launches, April.

Hans B.—On April 13th, this steel screw steamer, built by Messrs. Wm. Gray & Co., Ltd., for A. S. Bergen, for whom they have built several vessels registered abroad, had her trial trip. After adjustment of compasses, the vessel was headed to the north, and a run made along the coast as far as the Tyne and back, the performance of ship and machinery giving entire satisfaction to all concerned, and the mean speed being 12½ knots. The vessel afterwards proceeded on her voyage. See launches, April.

Auguszta Foherczegno.—On April 13th, this vessel, built by Messrs. W. Dobson & Co., Walker, to the order of Messrs. The Hungarian Levant Steamship Co., Ltd., was taken to sea for her fully loaded trial off the Tyne, when a speed of approximately 10¾ knots was attained on the measured mile and 10.66 knots for the six hours continuous run. The trials were witnessed by Mr. V. de Rottauscher, the Austrian-Hungarian Consul General. See launches, March.

Burmese Prince.—The s.s. *Burmese Prince,* lately launched by Short Brothers, Limited, Sunderland, left the Wear for her official trials. The trial was in every way a success, the engines working smoothly and steadily, and a mean speed of 12½ knots being reached. See launches, March.

Sandefjord.—The steel screw steamer, *Sandefjord,* built on the Tyne, to the order of Mr. P. A. Gron, of Sandefjord, has completed her trial trip with very satisfactory results, in spite of the rough sea. During the trial the whole of the machinery worked to the entire satisfaction of all concerned, and the ship registered a mean speed of 13 knots. After the trial the *Sandefjord* proceeded on her voyage to Narvik, under the command of Captain Berggreen. See launches, March.

Crof Khuen Hedervary.—The large steamer, *Grof Khuen Hedervary,* built at Walker-on-Tyne, for the Atlantica Sea Navigation Company of Budapest, has just completed her official trials. The vessel is capable of carrying about 7,200 tons deadweight on a moderate draught of water. The propelling machinery is of the triple expansion type. The cylinders are 26, 42, and 68 in. in diameter, by 48 in. stroke, and steam is supplied by two single-ended boilers. The trial trip was of four hours' duration, and in spite of a strong north easterly breeze and rough sea, the machinery worked without a hitch, a speed of 12½ knots being attained. The vessel returned to the Tyne for bunkers, and has since sailed for Newport, under the command of Captain Radan.

Carasa.—The steel screw steamer *Carasa,* built at Southwick for La Compania Naviera Vascongada, of Bilbao, has been out for her loaded trial trip. She has been built to take Lloyd's highest class, and under their special survey, as a single-decked ship with deep bulb angle frames and cellular bottom throughout for water ballast, with the after-peak as additional ballast. The engines are of the triple expansion type, having cylinders 21, 35, and 57½ in., with a stroke of 39 in., the steam being supplied by two large steel boilers with a working pressure of 180 lbs.

BOARD OF TRADE EXAMINATIONS.

NOTE—1C denotes First Class: 2C Second Class.

March 23rd, 1911

Adams, E. W.	1C	Glasgow
Avid, A.	2C	Liverpool
Auton, A. E.	2C	N.Shields
Baldry, A.	1C	W.Hart'l
Barr, A.	2C	Liverpool
Bisset, H.	2C	W.Hart'l
Bond, J. G.	1C	Liverpool
Brotherton, F.	2C	London
Bryce, A. W.	2C	N.Shields
Cadger, C. E.	2C	Leith
Cairns, A. C.	2C	Glasgow
Caldwell, A.	2C	Glasgow
Campbell, J. R.	2C	Cardiff
Crabtree, P. W.	2C	N.Shields
Dawson, D.	1C	Glasgow
Defty, H M.	1C	N.Shields
English, W. M.	1C	London
Foster, G. S.	1C	N.Shields
Frazer, W. H.	1C	N.Shields
Glover, C.	1C	W.Hart'l
Gray, G. S.	1C	N.Shields
Greig, J. P.	1C	Leith
Hawley, W. P.	1C	N.Shields
Henderson, J.R.	1C	South'ton
Holmes, F. G.	1C	W.Hart'l
Howard, W. A.	1C	London
Humphrey, G. J.	2C	Cardiff
Jones, A. G.	2C	Cardiff
Jones, W. M.	2C	Glasgow
Kendall, J. W.	2C	N.Shields
Kirsopp, E.	1C	Leith
Leeder, E. C.	1C	London
Mackie, J S.	2C	Glasgow
Malabar, S.	1C	Liverpool
Middlemist, R.	2C	Leith
Milburn, W.	1C	Glasgow
Mitchell, J. F.	1C	W.Hart'l
Mossman, E. H.	1C	Liverpool
Oswald, A.	2C	W.Hart'l
Overton, C.	2C	South'ton
Payn, H. J.	2C	Leith
Pidsley, S. H.	2C	Plymouth
Pittendrigh, R.	2C	London
Reekie, J.	1C	Leith
Richardson, A	2C	Liverpool
Samuel, W. T	1C	Cardiff
Saunders, G. W.	2C	London
Scott, W. J.	1C	Glasgow
Sharp, C. W.	2C	Cardiff
Smith, C. B.	1C	N.Shields
Strang, A. D.	2C	Glasgow
Tapley, R.	2C	Liverpool
Taylor, A. E.	2C	N.Shields
Thomson, C. H.	1C	Liverpool
Williams, T. D.	1C	Cardiff
Wilson, J. T.	2C	Glasgow

March 30th.

Ackerman, E. B.	2C	Aberdeen
Anderson, E.	1C	Hull
Austin, G. V.	1C	Liverpool
Brown, N. H.	1C	Liverpool
Cameron, D. P.	1C	Greenock
Carstairs, W.	2C	Greenock
Cochrane, G.	1C	Greenock
Craig, M.	1C	Sunderl'd

Currie, C.	1C	London
Dewsbury, P.W.	1C	London
Elliott, N. H...	2C	N.Shields
Fraser, C.	1C	N.Shields
Fraser, J.....	1C	Greenock
Girdlestone, H.	2C	Aberdeen
Goodwin, T. ..	2C	Liverpool
Gray, K	2C	Greenock
Gwynne, A. J...	2C	Bristol
Holden, P. E...	2C	Greenock
Hunter, T. L...	2C	Greenock
Inglott, V.	2C	Sunderl'd
Jones, D. A. ..	2C	London
Kirkpatrick, J.	2C	Greenock
Knowles, J.....	1C	Sunderl'd
Kydd, J.	2C	Aberdeen
Lonsdale, H .	2C	Liverpool
Masson, J.	2C	Aberdeen
McIntosh, R. ..	2C	Aberdeen
McKenzie, H...	2C	London
McLaren, A. ..	1C	Aberdeen
McPherson, A.	2C	Hull
Metcalf, T.	1C	Hull
Mitchell, W. C.	2C	Aberdeen
Munro, G.	1C	Greenock
Palmer, J. C...	1C	Sunderl'd
Reading, G. H	1C	N.Shields
Redding, J.....	1C	Sunderl'd
Richards, J. ..	2C	Hull
Richardson, R.	1C	N Shields
Riley, J.	2C	Aberdeen
Roberts, P ..	1C	Liverpool
Rutledge, F. ..	1C	Sunderl'd
Sibree, S. B. ..	2C	Hull
Smithson, O. J.	2C	Liverpool
Taylor, J.	1C	Greenock
Thomson, J. ..	2C	London
West, F. W. J.	1C	Hull
White, L	2C	Sunderl'd
Williamson, J.B.	2C	Sunderl'd

April 6th.

Aiken, J.	2C	Belfast
Anderson, R. ..	1C	Liverpool
Asquith, R.....	1C	Liverpool
Caramalis, D...	1C	N.Shields
Conner, A.	2C	Belfast
Corner, H.	1C	Cardiff
Crichton, J. A.	2C	South'ton
Cuthell, J. D. ..	2C	Liverpool
Daniels, W. W.	1C	London
Davis, A.....	2C	London
Gimmett, S. ..	1C	London
Greener, P.	2C	Liverpool
Grieve, G. P. ..	2C	Leith
Herapath, C. ..	2C	Cardiff
Holthouse, C.S	2C	London
Johnston, A. ..	2C	Glasgow
Kelsey, H.	2C	N.Shields
MacLachlan, C.	1C	Glasgow
Mathewson, H.	1C	Leith
McInnes, J.....	1C	Glasgow
Mordue, J. H...	2C	N.Shields
Morris, H. G...	2C	Liverpool
Morris, W.	2C	Cardiff
Neill, C.	1C	Belfast
Oliphant, W. A	2C	Glasgow
Robertson, A...	2C	Glasgow
Robinson, H. ..	2C	Liverpool
Roe, A.....	1C	Glasgow
Rowles, C.	2C	Cardiff
Samuels, R. G.	2C	Glasgow
Sharland, W. ..	2C	South'ton
Smythies, R. ..	2C	South'ton
Somerville, E H.	2C	Liverpool
Spence, B.	2C	Cardiff
Steel, J. W. ..	2C	Belfast
Stephenson, F.	1C	Cardiff
Steven, W.	2C	Glasgow
Stevenson, W	1C	Liverpool
Symes, R.	2C	Belfast
Tolnie, D	1C	Glasgow
Watkins, A. ..	2C	Cardiff
Watson, H. J...	2C	N.Shields
Whitfield, R. H.	2C	London
Williams, J. J	1C	South'ton

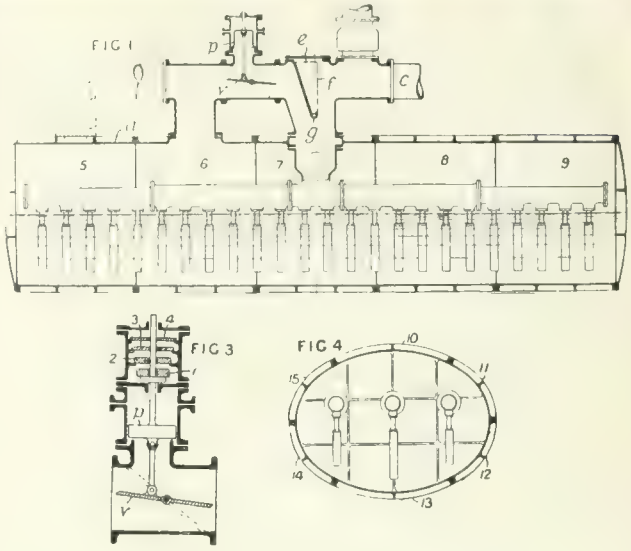
April 13th

Bennett, H. A	1C	N.Shields
Cook, C.	1C	N.Shields
Davie, J. N. ..	2C	N.Shields
Fenwick, J. C	2C	N Shields
Garriock, R. ..	1C	N.Shields
Gillman, C. H.	1C	London
Harding, C. P.	1C	Greenock
Hendry, R. J ..	2C	Dundee
Houston, P. ..	2C	Greenock
James, V. O. ..	2C	N Shields
Leitch, D.	1C	Dundee
Maclean, A.....	2C	Liverpool
Magoulas, S. ..	2C	N.Shields
Mason, C. H. ..	1C	N Shields
Matthew, D. ..	1C	Dundee
McMillan, J. H.	1C	Greenock
Musker, A.	2C	Liverpool
Owen, W. H,..	2C	Liverpool
Richardson, R.	2C	Greenock
Richmond, W.	1C	Hull
Riley, A. T.....	2C	Greenock
Robson, A	2C	Hull
Russell, D. C...	1C	Greenock
Scott, H. P. ..	2C	N Shields
Simpson, J. M	2C	Dundee
Thomas, W. ..	1C	Liverpool
Usher, H.	1C	Liverpool
Warnock, J. F	2C	Greenock
Williams, S	2C	London
Woods, W. E	2C	Liverpool

The Marine Engineer and Naval Architect Patent Record.

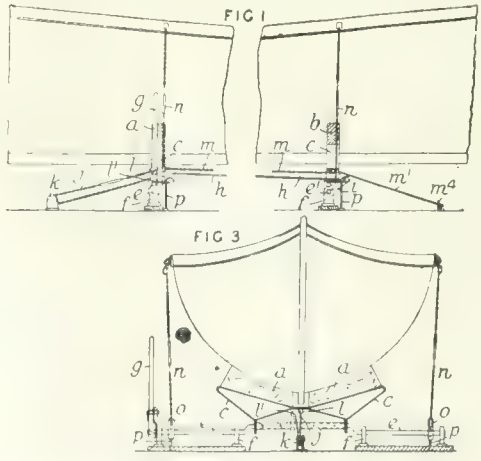
Compiled by Messrs. E. P. Alexander & Son, Chartered Patent Agents, 306, High Holborn, London, W.C.

28,223. Steam-generators. *Steam regenerative accumulators*, such as those described in Specification No. 22,025, A.D. 1907, are built up of circumferentially flanged sections, which may themselves be composed of longitudinally flanged sections. As shown in Figs. 1 and 4 the accumulator *a* is built up of the flanged sections 5 . . . 9, which are constructed of the flanged segments 10 . . . 15. Exhaust steam entering by the pipe *c* impinges upon the separator *e* composed of multiple plates *f* draining into a trough *g*. The by-pass valve *v* is controlled by the piston *p*, which is water-sealed. For higher pressures, the piston *p* may be loaded with a weight 1, and with additional weights 2, 3, 4 as it is displaced vertically.



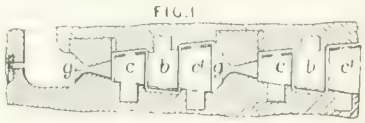
No. 288223.

29,014. Boat-supporting gear. Relates to chocks of the kind mounted on transverse rock-shafts and coupled together to move simultaneously in a fore-and-aft direction, the boat gripes being released at the same time. The chocks *a*, *b*, connected by a chain, are fitted to frame-works *c* which are eccentrically hinged to transverse crank-shafts *e*, *e*1 working



No. 29014.

in bearings *f*. The inboard end of the shaft *e* is provided with an operating-lever *g* connected by a link *h* to an arm *i* on the shaft *e*1. The forward chock is kept in a vertical position by a chain *j* passing round a pulley *k* and connected to the chock *a* at *l* and also to an arm *l*1 on the crank-shaft. The aft chock is also steadied by a rod *m*1 working in a thimble *m*4. The gripes *n* are threaded through eye-bolts *o* which are fitted over vertical hooks *p*, the shanks of the bolts engaging with projections carried by the crank-shafts.



No. 29119.

29,119. Turbines. Relates to impulse turbines of the kind in which the pressure energy of the motive fluid is fractionally converted into kinetic energy by nozzles *g*, and consists in gradually increasing the dimensions of the blades *c*, *b*, *c*1 at each stage so as to reduce to a minimum all resistance to free flow, and to avoid spilling.

The Marine Engineer

And Naval Architect.

LONDON, JUNE, 1911.

TURBINE-DRIVEN SHIPS.

THE subject of the propulsion of ships continues to occupy the attention of engineers to a very marked degree, as is exemplified by a paper read recently before the Liverpool Engineering Society by Mr. J. K. Catterson-Smith, A.M.I.E.E., on the manufacture of turbo-electric generators and some of their applications to marine work. In a recent issue we dealt with the subject from the broad standpoint of the relative merits of toothed gears, hydraulic gears and electric gears, consequently it is unnecessary to go over the same ground again, but we think it may interest our readers if we deal with some points of detail raised by Mr. Catterson-Smith on the matter of electric gears. It must be remembered that up to the present, although the two former gears have been applied on ships and results have been obtained, there is no record of any example of the latter gear having been installed on shipboard and practically tested. The author claims that the chief advantages of electric drives are:—No practical limit to power, electro-magnetic gear in place of teeth, simple methods of varying the gear-ratio, maintenance of efficiency over large range of power by sub-division of generators, and no uncertainty regarding operation and durability of plant. Apart from questions of weight and economy, it is absolutely essential that the electric coupling should admit of an extensive range of speed control, together with effective reversing powers for braking and going astern while the vessel is being manœuvred. The types at present available are direct current motors, single-phase commutator motors, and poly-phase induction motors, all of which are capable of variable speed control. Direct current motors would be supplied by direct current turbo-dynamos, and single and polyphase motors by turbo-alternators. There would appear to be a certain similarity between electric train haulage and ship propulsion, thus pointing to the advantages of propeller motors having such characteristics, although it may be agreed that the characteristics of induction motors would meet the requirements of all vessels except those in which exceptional manœuvring capabilities are required, as the turbine itself is capable of a wide speed range. The direct current system has important advantages in the matter of flexibility as to speed and torque to meet the requirements of the vessel, while the propeller motor can be of any size if the voltage is increased with the size of the unit. The author cites the case of a rolling mill motor which was capable of giving 12,000 B.H.P. at 60 revolutions per minute on 880 volts. The speed control of such motors is easily obtained by variable voltage generators, motor field control, or compound winding on the motor field. When the ship is to be stopped, the propeller driving the motors would enable the latter to regenerate and deliver back energy to the main generators, where it would be absorbed by a water-cooled brake, or a steam blade brake, or the energy could be dissipated by resistances. Although propeller motors of large power present no difficulty, it is found that present-day direct current turbo-dynamos have a distinctly limiting feature in the matter of providing commutator capacity, and in support of this the author gives some interesting tables and formulæ showing the maximum voltage possible under certain conditions. With regard to polyphase generators, it is pointed out that commercial firms are prepared to construct motors up to 3000 B.H.P. continuous rating. The limitations as to size of this class of motor are not of any serious moment, but whatever they are, the principal difficulty will be with the propeller motors, instead of with the generating sets as in the direct current system. Dealing now with polyphase induction motors, it is pointed out that this system in various forms is the one most applicable, owing largely to its simplicity. Some interesting particulars are given in the paper of an extremely simple three-phase system recently proposed to the U.S. Government for a battle-ship. The main machinery was to consist of two 12,000 K.W. three-phase generators, having a maximum speed of 1,200 revolutions. Twin screws with two 7,000 H.P. motors to each shaft were to be fitted, thus with full load 28,000 H.P. would be transmitted. When at full power the two motors forming one set each have 30 poles, the gear ratio then being $7\frac{1}{2}$ to 1, and under these conditions the speed would be controlled by the turbine speed. For lower speeds one generator and one motor on each shaft would be cut out, leaving the gear ratio the same. For still lower speeds the number of motor poles would be changed to fifty, giving a gear ratio of $12\frac{1}{2}$ to 1, and the turbine be allowed to work over its whole speed range again. Some interesting tables of gear ratio between alternator and motor are included in the paper.

THE COLONIES AND SHIPPING.

IT is seldom that a more representative deputation is received by a high Officer of State than the large and influential body of gentlemen from the Shipowners' Parliamentary Committee, who in the middle of last month had the opportunity of expressing their views, on the subject of colonial legislation affecting merchant shipping, to Mr. Sydney Buxton, the President of the Board of Trade. It would appear from the statements made that the deputation represented directly or indirectly 95 per cent. of the British owners registered. The purpose of the

deputation was to emphasize the importance of matters which were debated at the Colonial Conference in 1907, and which it is understood the Colonial Representatives are going to press very strongly at the current Imperial Conference. If their demands are acceded to the result to a large extent will be a revolution in the interests of the shipping of the Empire. As Mr. Norman Hill, of Liverpool, pointed out, Sir W. Line contended at the last Colonial Conference that "The requirements and laws relating to shipping should be uniform throughout the Empire but I consider the lines of New Zealand legislation and Australian legislation should be generally followed as a term of uniform law, and that Foreign Ships must be subject to all the requirements of British Ships." If this is the programme it is quite clear that the utility of the Conference of 1907 has been materially reduced and it does not even seem to have had merely an educational value. Looking at the matter quite impartially and having regard to the enormous preponderance of British over Colonial shipping it would appear to be manifestly unreasonable for the Colonies to press a policy on the ground of uniformity under which the British owners are controlled and handicapped and their business exploited for the benefit of another community altogether, while the freedom which is the essential factor for the successful running of British shipping is to be destroyed. There can be no possible objection to the reduction of maritime law to suit the empire as a whole so long as the basis of settlement does not rest on the narrow lines of Colonial policy, as such a course would be impossible to carry out without the gravest injustice. We feel sure that Mr. Buxton will be assisted and materially strengthened by all he heard from the deputation when he comes to deal with the various proposals at the Conference, and we trust he will do all he can to come to an amicable settlement and maintain the integrity of the position, as far as the Mother Country is concerned.

NATIONAL INSURANCE.

THE State Insurance Scheme which has been submitted to Parliament has the merit which attaches to all proposals calculated to improve the conditions of life, especially to those who are least able, on account of their environment, to look ahead and plan for themselves. It has apparently less of the demerit than sometimes is allied to philanthropic schemes, the framers of which frequently consider their subject from one point of view alone, overlooking constitutional questions upon which the grit of a nation depends. The Workmen's Compensation Act has given rise to many abuses and to many hardships, as has also the Old Age Pensions Act, but to a smaller extent, and in directions which admit of more easy rectification; the amendments now proposed will probably accomplish this. It is therefore important that the new Act should be carefully considered and discussed in all its bearings before being passed into law. The Friendly Societies who are deeply interested in the scheme appear as a whole to be favourably impressed and are prepared to discuss the terms with favouring criticism. The medical faculty may not be quite so favourably inclined, but the reasonable opinions expressed in regard to the Act show that medical men are considering the provisions with approval provided that the interests of all concerned be carefully thought out, discussed and safeguarded from a broad-minded statesman's point of view. That costs of material will be raised all round may be taken for granted owing to the weekly contributions from employers and employed adding to the workshop expenses, and this in view of applications now under consideration for further advance of wages. The heads of firms, however, who have spoken on the subject have on the whole expressed views assenting to the desirability of establishing a national scheme. The tendency of the Act will have a compelling influence on the thriftless towards a provident habit. The steady seamen and firemen will be greatly advantaged by the Act; many of them, being connected with Life Assurance Societies for small amounts, have already acquired the habit of regular payments for the benefit of those dependent upon them. The proposal which is now under discussion of weekly payments in place of advance and allotment notes, payable monthly, would, if carried into effect, facilitate the working of the details of the Act. The general effect of a National Insurance Scheme should have a steadying influence on those who are too easily led away from duty; unfortunately there are many such, and there will be considerable difficulty in administration to deal with these.

THE PROFESSION OF NAVAL ARCHITECT.

WE are always pleased to note large bodies and associations recognising their responsibilities with reference to professions to which they owe so much, and on which they rely for that accumulation of knowledge and the practical application of scientific principles on which their successful operation so largely depends. We therefore desire to congratulate the general committee of Lloyd's Register of Shipping on their decision to institute three scholarships in Naval Architecture in connection with the University of Liverpool. We understand that the value of each scholarship is £50 per annum, available for three years and one will be awarded annually. It is arranged that the first will be awarded as the result of the entrance scholarship examination in September next. An important condition is included amongst others that competitors must show knowledge of practical shipbuilding. We believe that this offer

by Lloyd's Committee is the result of the efforts of Professor Abel on his own suggestion to the committee. The Professor at the present time holds the Chair of Naval Architecture at the University of Liverpool and we congratulate him on the success of his efforts.

It is interesting to note that Sir Philip Watts, the Director of Naval Construction, is to be the Examiner for all the branches of the subject.

POSTAL REFORM.

THE need for some reform in the postage rates on monthly newspapers has been felt for a long time past, and numerous efforts have been made to effect some alteration, but without the success they deserve. Recently the matter has again been brought into prominence by the London Chamber of Commerce, the Institute of Journalists, and by the *Agricultural Economist and Horticultural Review*, a monthly periodical. Various meetings have been held and a deputation has waited on Mr. Herbert Samuel, the Postmaster-General. As Mr. T. Henniker Heaton points out, it is intolerable to pay 4d. to send a magazine weighing a pound to Canterbury, in New Zealand, and the same magazine to Canada for 1d. It has been ascertained that the British postal charges on monthly periodicals are the highest in the civilized world, which it must be agreed constitutes an oppressive tax on knowledge for which there is no reasonable justification. The answer given by Mr. Samuel to the deputation was a refusal to grant concessions and a repulse to the step made. However, the matter is not to rest there, as a new movement is likely to be organized on a broad basis capable of embracing all classes of the post-office-using public who have grievances. A strong committee has been formed to carry the movement on in furtherance of postal reform and it is earnestly hoped their efforts, with which we are wholly in accord, will be successful.

SEAMEN AND FIREMEN.

THE spirit of unrest which has been abroad of late in shipbuilding centres assumed a rôle during May in keeping with the merry month, and with the general apprehension of the festivities to be clustered around the United Kingdom in the course of the summer. The idea of large camps on the outskirts of the docks, where seafarers could meet and enjoy themselves for a fortnight was a great one, and the placards announcing the arrangements appeal to the sympathy of all who are interested in the sailor—and who is not in this sea-girt isle of ours? The later circular gives a prominent place to the children of schools within the neighbourhoods. The dates of the festival with sports and pastimes have been slightly altered, but the end of May or beginning of June is approximately the time when the tug of war may be witnessed and mayhap the hornpipe applauded by the spectators assembled for the occasion. The threatened international strike proposed under cover of the camp tents has somewhat spoiled the effect of the atmosphere to the general public by removing the veil and revealing the undercurrent. Verily there appear to be many things which roll beneath the current which require to be explained.

REFRIGERATING APPARATUS FOR MARINE TRANSPORT.

[*Continued from Page* 293.]

THE EVAPORATOR.

THE evaporator consists of another set of pipes, which may be in the form of a grid or may be again in a coil, placed in a tank. There is always the most important valve in the whole apparatus, between the receiver if there is one, and the evaporator, or between the condenser and the evaporator. It is called the expansion valve, and it controls the passage of the liquid refrigerant into the expansion coils. The expansion valve is very carefully made, being ground into its seat, and a very small movement allows a sufficient quantity of the liquid to pass through. On passing through the expansion valve the liquid enters the expansion coils, where the space open to it, in which to expand, is very large. In expanding it should fill the whole of the expansion coils, and in expanding it extracts the heat required to assume the gaseous condition, from the surrounding objects. The other end of the expansion coils is connected by a pipe to the suction valve of the compressor. Marine engineers will have noticed frost on a pipe leading to the compressor of plant that has been shown at exhibitions. The pipe with frost on is the suction pipe leading from the end of the expansion coils to the suction valve of the compressor. The gas in expanding assumes a low temperature, and it is at this low temperature when passing through the suction pipe to the compressor, hence any moisture which is in the atmosphere condenses upon the cold surface of the pipe, and is converted into snow in the usual way.

When the apparatus is working properly, the refrigerant is continually circulating round and round through the system. Some of it is constantly expanding to a low temperature in the expansion coils, some of it is constantly being compressed in the compressor, and some of it is constantly being liquefied in the condenser.

The temperature to which the cold store, or the brine tank to be described presently is reduced by the expansion of the refrigerant, depends upon the quantity of the refrigerant that is allowed to pass through the expansion valve. The quantity of the gas that is required will depend upon the area it has to serve, the area of the cold chamber controlled by the expansion coils, and the temperature to which the air, or the produce in the cold store, has to be lowered. It will easily be understood that the lower the temperature at which the cold store has to be held, the larger is the volume of the gas which has to be handled by the compressor, and therefore the larger is the amount of work done by the compressor. Hence, as will be explained later, the power required to drive the compressor varies with the cubical content of the cold chambers to be controlled, and with the temperature at which they are held.

BRINE COOLING.—For certain purposes direct expansion, as it is termed, has certain disadvantages. The grid of expansion pipes may be fixed in the cold store, or in a tank in which ice is to be made. With carbonic acid, and sulphurous acid, there is no objection to this, and direct expansion is often employed where these refrigerants are used. With ammonia, however, should there be a slight leak in the expansion pipes, the ammonia gas might affect the produce in the cold store, or the ice in the ice tank. Hence secondary cooling by the aid of brine is adopted for certain purposes. In addition to avoiding the danger of escaping gas, the use of brine cooling enables a better control to be obtained of different cold chambers. This is of great importance where chilled beef is carried. With chilled beef cargoes it is usual to divide the hold, which is insulated as a whole into sections. Each section has its own grid of brine pipes. The whole of the brine returns to a common tank, before passing to the evaporator tank to be re-cooled, and the attendant is able to tell, by the aid of thermometers placed in the path of the return brine, the condition of each section of each hold, and by increasing or decreasing the rate of the flow of brine in the coils of that particular section of the hold, to lower or raise the temperature of the section as may be desired.

In brine cooling the expansion pipes are usually formed into a coil, which is immersed in a tank containing brine.

Fig. 7 shows one form of evaporator tank, arranged for cooling brine, and also for cooling air. The brine is kept circulating through the tank and through a grid of pipes, or other arrangements to be described, which are performing the actual cooling. Grids of brine pipes are placed in the cold stores, and the brine is kept circulating through them, and through the evaporator tank. The cold brine passing into the grid of pipes in the cold chamber extracts heat from the air of the chamber and thence from the produce. Having extracted a certain quantity of heat, and having its own temperature raised a few degrees, it passes back to the brine tank, where it gives up the heat which it has absorbed in the cold chamber, to the evaporator coils, passing back again to the cold chamber. The brine is kept continually circulating round and round, through the brine tank, through the pipes connecting it with the grid, and through the grid. Again it is important that the circuit should be closed always. Any leakage will be bad for the efficiency of the system. Fig. 8 is a diagram of the brine circuit showing the evaporating tank, the brine grid and connecting pipes.

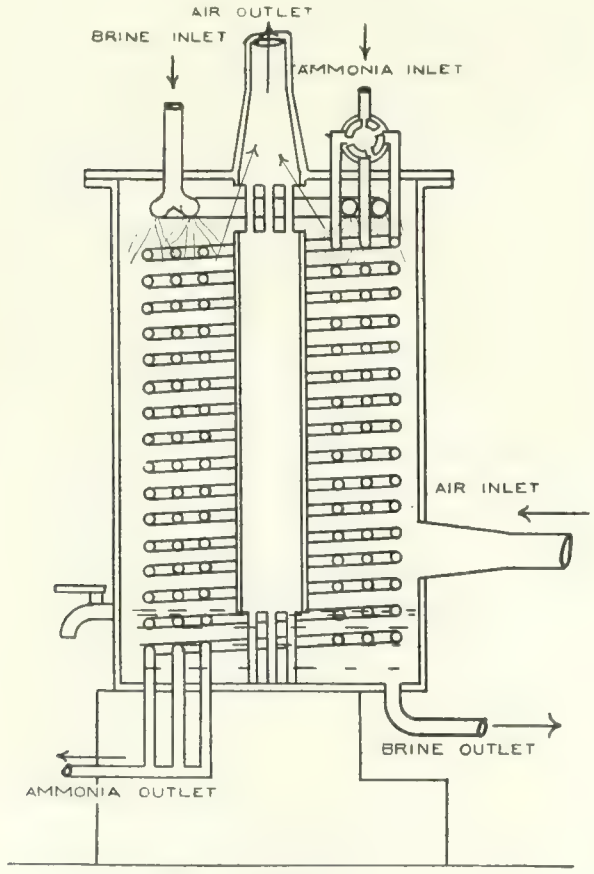


Fig. 7.

The brine is kept in circulation by any convenient form of pump. There are a number of double pumps on the market. With small plant the brine pump is usually driven from the same crank shaft as the compressor piston. With larger plants, and particularly with the large amount of brine circulation required for ships' holds carrying chilled beef, the pump is sometimes driven separately by an electric motor. Fig. 9 shows a small plant, in which the evaporator tank, the condenser and the compressor and brine pump are all carried by one bedplate.

It will be seen now how the heat is transported from the cold chamber to the water in which the ship is floating. The heat which has leaked into the chamber, or which is present in the produce, is absorbed by the cold brine. The brine, whose temperature has been slightly raised, delivers the heat it has abstracted from the cold chamber to the evaporator coils. The refrigerant, which is circulating through the evaporator coils, carries the heat which it has abstracted from the brine back to the compressor, and thence to the condenser. In the condenser the heat which originally came from the cold chamber, is delivered to the cooling water, and in the case of board ship work, is pumped overboard.

Why Brine is Employed, and What is meant by Brine.

By brine is usually understood salt and water, but in cold storage work it includes a solution of common salt, a solution of calcium chloride or of magnesium chloride. Solution of sodium chloride (common salt) is not often used, because

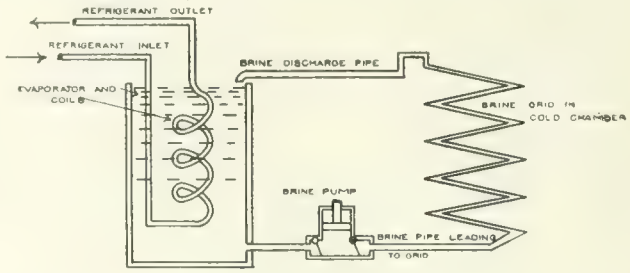


Fig. 8.

of its chemical action upon the iron pipes that are generally used for the brine circulation, and for the brine grids. In this country, and in ships trading and fitted out in this country, calcium chloride is usually employed. It has practically no chemical action upon iron, providing that it is pure. In Germany, magnesium chloride is used, and in a few cases in the United Kingdom, where plant has been put down by German firms, as in the case of shaft sinking by the aid of the freezing process, magnesium chloride has been used.

Brine of any kind is employed, because its freezing temperature is lower than that of water. As mentioned in connection with the temperature at which produce is to be held, immediately water holds any salt in solution its freezing temperature is lowered. In the case of calcium chloride, 5 per cent. of the salt lowers the freezing point to 27·7°F., 10 per

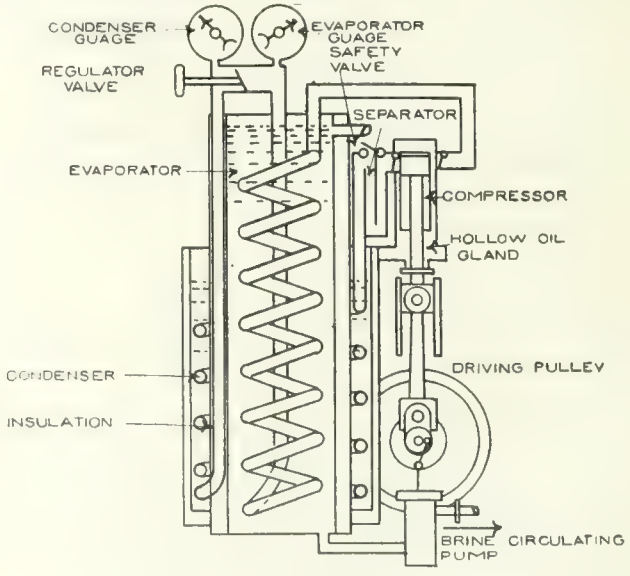


Fig. 9.

cent. lowers it to 22·4°F., 15 per cent. to 12°F., 20 per cent. to minus 1·5°F., 25 per cent. to minus 21·8°F., and 30 per cent. to minus 54·4°F. So that a solution of calcium chloride may be made up whose freezing point will be at any figure that is desired. It is important that the quantity of the salt in solution should not be greater than is necessary to keep the freezing point at the proper figure, because if the solution is denser than is necessary, a portion of the salt will deposit upon the inside of the brine pipes, and as in the case of the salts from sea water mentioned in connection with the evaporative condenser, will prevent the passage of heat

through them, from the produce to be cooled to the brine. The solubility of calcium chloride decreases as the temperature falls. At 32°F., the freezing point of water, a gallon of water will dissolve 5 lbs. of calcium chloride. At 14°F. it will only dissolve 4·2 lbs., and at minus 4°F. it will only dissolve 3·6 lbs. From the figures given above for the freezing points of the solution of calcium chloride, with different percentages of the salt, it will be seen that there is plenty of margin for obtaining a sufficiently low freezing point, without having an unnecessarily high density. It may be interesting, however, to point out that both sodium chloride (common salt) and magnesium chloride vary very much less in their capacity for dissolving in water, with different temperatures, than calcium chloride. At 32°F., a gallon of

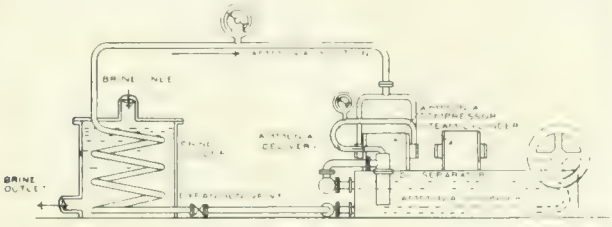


Fig. 10

water will dissolve 3·55 lbs. of sodium chloride, and at minus 4°F. the quantity has only been reduced to 3·18. With magnesium chloride, at 32°F., a gallon will dissolve 5·6 lbs., and at minus 4°F. it dissolves 5·3 lbs.

It will be understood that brine is used in place of water, because water would freeze in the pipes at the temperatures at which the cold stores or the ice tanks are to be held, while the brine does not. And in addition, with brine, the engineer can arrange, without difficulty, to hold his produce, his ice tank or his cold store, at any temperature he pleases, without danger of trouble from the freezing of the circulating liquids. Fig. 10 is a sectional diagram of a favourite form of compressor, with condenser in the bedplate and evaporating tank or brine cooler separate.

(To be continued.)

DIESEL ENGINES FOR SEA-GOING VESSELS.

By J. T. MILTON, Esq.

(Continued from page 382.)

IN making these calculations of the stresses caused by the bending moments and torsion moments combined, the former have been assumed to be due to the greatest load coming on the piston which occurs at the commencement of the stroke. Although the load is slightly lessened at the instant when the greatest torsion moment is acting, the reduction is not nearly so much as that which occurs in the Diesel engine, and it has not been taken into account. In all these cases the size of shaft is assumed to be that which would be the minimum required by Lloyd's Rules, not the somewhat larger shafts actually fitted by the makers in each case.

The combination of the bending and torsion moments has been made by the usual formula, and as a result an average stress of 7,302 lbs. per square inch was obtained. It must be distinctly stated again that it is not claimed that these figures are absolutely correct, as they are obtained upon certain assumptions regarding the bending moment, but they are reliable as a means of comparison with figures obtained in precisely the same way with other engines.

It now remains to apply this stress intensity to the shafts of the Diesel engine.

As an example, let us take an engine with, say, four cylinders, two-stroke cycle, single-acting. Its diameter of cylinder = D inches, its stroke S inches, and its span of bearings L = 1·2 S; that is to say, its proportions being the same as those taken in Tables I., II. and III., and assume the compressors to be worked from the forward end of the crank shaft. We shall have the load on piston $= D^2 \times \frac{\pi}{4} \times$ 500 lbs.

From Table III. we see that the maximum combined moment on the crank shaft, estimated as a bending moment, is, Load on piston × stroke × ·251. Hence, if d is the diameter of shaft, which will give a stress of 7,300 lbs. per square inch—

$$d^3 \times \frac{\pi}{32} \times 7300 = D^2 \times \frac{\pi}{4} \times 500 \times S \times \cdot 251.$$

from which

$$d^3 = D^2 S \times \cdot 1375.$$

and

$$d = \sqrt[3]{D^2 S \times \cdot 1375}.$$

This rule is only suitable for cases in which L is 1·28. As has been stated, the rule can be put into the form $D = \sqrt[3]{D^2 (A S + B L)}$ to suit all ratios of $\frac{L}{S}$ from 1·2 to 1·8.

The following Table V. gives the suitable values of A S + B L :—

TABLE V.

Values of (A S + B L) in the formula $D = \sqrt[3]{D^2 \times (A S + B L)}$.

Description of single-acting engine.	For engines with separate compressors.	For engines where compressors are worked from fore end of crank shaft.
1, 2 or 3 cylinders ..	·089 S + ·037 L	·086 S + ·038 L
4 cylinders	·099 S + ·036 L	·093 S + ·037 L
5 or 6 cylinders ..	·111 S + ·035 L	·103 S + ·036 L
8 cylinders	·131 S + ·033 L	·120 S + ·034 L

We have next to determine a rule for tunnel shafts, which are subject to torsion only. In the steam engine the usual practice is to make the tunnel shaft $\frac{20}{21}$ of the diameter of the crank shaft.

In Table IV. it is seen that the average stress caused by the maximum torsion moment upon shafts of the sizes required by Lloyd's Rules for the crank shafts of the engines under consideration is 5,123 lbs. per square inch. As the tunnel shafts will be $\frac{20}{21}$ of the sizes of the crank shafts, the average of the stresses on them will be $\left(\frac{21}{20}\right)^3 \times 5{,}123 = 5{,}930$ lbs. per square inch.

Taking again the four-cylinder engine, we see from Table III. that the maximum torsion moment to be provided for is—

Load × stroke × ·231.

Hence, if d_t be the diameter of the tunnel shaft to give a maximum stress of 5,930 lbs. per square inch, we get—

$$d_t \times \frac{\pi}{16} \times 5{,}930 = D^2 \times \frac{\pi}{4} \times 500 \times S \times \cdot 231.$$

whence—

$$d^3 = D^2 S \times \cdot 07791.$$

In this way we get the following Table VI. :—

TABLE VI.

GIVING THE VALUE OF THE CO-EFFICIENT REQUIRED IN THE FORMULA.

Diameter of tunnel shaft = co-efficient × $\sqrt[3]{D^2 S}$.

Description of single-acting engine.	For engines with separate compressors.	For engines where compressors are worked from fore end of crank shaft.
1 or 2 cylinders ..	·456	·454
3, 4, 5 or 6 cylinders	·436	·429
8 cylinders	·406	·452

It is to be noted that no allowance is made for the equalizing effect on the torsion moment of the fly-wheel, which must be fitted in engines with a small number of cylinders. As against this, however, it may fairly be set that not only will the fly-wheel be as small as will suffice to enable the engine to turn the centres, but also in these engines the range of stress through the inequalities of the torsion moments is considerably greater than in the steam engines which are taken as standards of comparison, and experience shows that with a large range

TABLE IV.

GIVING PARTICULARS OF SHAFTS, ETC., OF MARINE ENGINES.

No.	Diameter of Cylinders. Inches.	Pressure, Lbs. per sq. in	Revs per minute	Indicated horse-power.	Maximum steam pressure on pistons. Lbs. per sq. in.			Proportional loads on pistons.			Crankshaft diameter by L.R. rule.	Distance between centres of bearings. Inches	Max. torsion moment 1,000 lbs. per sq. in.	Max. bending moment 1,000 lbs. per sq. in.	Max. torsion stress = 1·262 mean. Lbs. per sq. in.	Stress per combined moment. Lbs. per sq. in.
					H.P.	I.P.	L.P.	H.P.	I.P.	L.P.						
1	25, 40, 68 by 48 stroke	180	86	2470	120	54	19·0	120	138	140·6	13·277	44	2286	380	4973	7132
2	23½, 38, 64 by 42 stroke	180	97	1353	124	45	16·0	124	117·5	118·4	12·198	39¼	1605	253	4504	6420
3	18, 30, 50 by 36 stroke	180	83	882·3	105	48·5	18·2	105	135	141	9·777	34	846	152	4616	6677
4	26, 43, 70 by 45 stroke	180	64	1843	115	48	19·2	115	131	139	13·393	44½	2291	411	4857	7024
5	30, 48, 78 by 54 stroke	160	62	2882	106	54	18·0	106	137	121·5	14·932	57¼	3699	621	5059	8121
6	30, 48, 78 by 54 stroke	160	61	2974	106	62	15·8	106	158·5	107	14·932	57¾	3880	545	5935	8361
7	25, 42, 71 by 48 stroke	200	78	2821	128	58	18·5	128	163·5	148·5	13·894	52¾	2878	483	5465	7854
8	20½, 44, 72 by 48 stroke	180	76	2770	120	57	17·0	120	157	125	13·876	49¼	2900	426	5527	7822
9	26, 43, 70 by 48 stroke	180	69	2184	108	48·0	16·0	108	133	116	13·686	48¼	2519	371	5004	7085
10	24½, 40, 66 by 45 stroke	180	66·5	1521	112	40·5	15·0	112	108·5	109	12·846	43¾	2001	278	4807	6764
11	27½, 43½, 73 by 48 stroke	180	71	2332	128	54·4	17·4	128	130	124	14·086	48	2614	430	4763	6830
12	19, 31, 51 by 30 stroke	180	78	1080	108	55	20·4	108	146	147	10·667	32½	1102	168	5500	7796
13	26, 42, 70 by 48 stroke	180	62·5	1991	121	44·7	19·5	121	116	141	13·573	45½	2535	427	5163	7413
14	26, 42, 70 by 48 stroke	180	65	2018	122	48	18·0	122	125	130	13·573	45½	2471	394	5032	7181
15	25, 41, 68 by 48 stroke	180	62	1632	117	48	15·1	117	129	112	13·330	48¼	2095	334	4504	6415
16	25½, 42, 69 by 48 stroke	180	70	2270·5	118	54·5	17·75	118	148	129	13·508	45¼	2588	379	5347	7505
17	25, 42, 69 by 48 stroke	180	75	2420	114	44·8	16·0	114	126	122	13·395	45¼	2567	342	5438	7668
														Mean:	5123	7302

of stress a shaft cannot stand so high a maximum stress as may be safely borne when the range is small.

The calculations have been made for the two-stroke single-acting type of engine. They will all be equally applicable to the four-stroke single-acting engine with double the number of cylinders.

With regard to the double-acting type of two-stroke cycle engine, with the exception of there being no allowance made for the lessening of the piston area for the upstroke due to the piston rod, the single-cylinder engine will compare in all respects with the two-cylinder single-acting engine. The two-cylinder double-acting engine with cranks at 90° will also compare with the four-cylinder single-acting so far as tunnel and screw shafts are concerned, but the crank shaft will not be so much strained, owing to there being no part of it in the same condition as the third crank of the four-cylinder engine. The maximum torsion on the crank shaft will be the same as that on the shaft of a two-cylinder single-acting engine. Three-cylinder engines with the cranks equally spaced, and four-cylinder engines with cranks spaced 90°, 45°, 90° and 135°, will be under the same conditions as single-acting engines with six cranks at 60°, and with eight cranks at 45° respectively, there being in these cases the corresponding phases which bring the greater torsion moments upon some of the cranks.

In conclusion, reference should be again made to the kindness of the various firms and individuals mentioned in furnishing so much information as they have done. The author also wishes to acknowledge the great assistance he has had from Mr. J. E. Milton, in dealing with the very numerous calculations and diagrams which have been made in order to obtain the results given in the Tables.

H.M.S. "INDEFATIGABLE."

THE *Indefatigable* represents the cruiser edition of battleship *Neptune* — dealt with in our April issue—and is the first of three ships of her class to be completed, the other two being the *Australia* and *New Zealand*, which are still on the stocks and being built for the Colonies whose names they bear. The type is a natural development of the precursor *Invincible*, although differing greatly in appearance. It will be remembered that the earlier battle-cruisers had their amidships turrets placed *en échelon*, but the guns had restricted cross-deck arcs of fire owing to their length being insufficient for the turrets to be more widely spaced.

In the *Indefatigable* this defect has been remedied by increasing the length from 562 feet to 580 feet over all, and utilising the extra space by giving each amidships turret a wide cross-deck bearing. This modification has led to a considerable re-arrangement of the funnels and superstructure, as instead of having two funnels forward of the amidships guns and one aft, the second uptake has been placed between the turrets, the small superstructure around it being cut away so as to allow for the maximum arcs of fire. The main-mast is stepped right aft instead of close up against the third funnel, with the result that the ship presents a peculiarly irregular profile, and has already been christened "the ugliest ship in the Navy." To keep the forebridge clear of smoke and "stokers" the fore funnel is raised about 15 feet higher than the other two, and this tends to accentuate her philistine appearance.

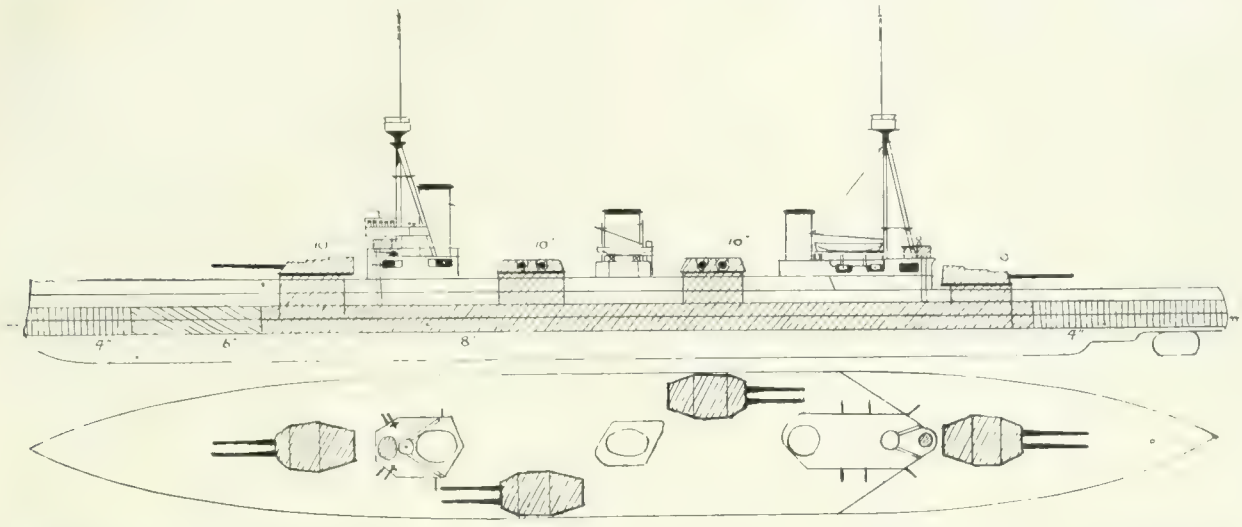
The dimensions of the *Indefatigable* are:—Length, 555 feet between perpendiculars and 580 feet over all, beam, 80 feet and mean draught 26½ feet, the normal displacement being 18,750 tons. On trial the draught was exceeded by about a foot, and the actual displacement seems to have been nearer 19,200 tons, though this has not affected her steaming powers.

Last December on her preliminary run a speed of 27 knots was registered; a new type of propeller was then fitted, and on Monday, April 10th, the vessel left Cawsand Bay to complete her acceptance trials, during which the splendid speed of 28 knots was attained. The results are as yet confidential, but it is understood that the vessel can be relied upon to maintain 27 knots in a sea-way continuously, and this with a considerable reduction in the number of

revolutions and consequent general stress upon the machinery. The difference between the actual and designed draught is being investigated and it is confidently expected that it will be possible to effect a remedy without much difficulty.

The armament of the *Indefatigable* is similar to that of the *Invincible*, except that the 12″ guns are of the new 50 calibre pattern instead of Mark XI 45 calibres. Recently we discussed the pros and cons of the *en échelon* arrangement of the amidships turrets in the "Neptune" class as opposed to the all-centre-line disposition adopted by the later "Lion" and "Orion" types. On paper the *Indefatigable* can bring six guns to bear fore and aft and eight on either beam, while the *Lion* should fire four forward, two aft and eight abeam.

In actual practice, however, these concentrations of fire must be considerably modified. According to reliable reports no attempt was made to fire the "off" guns across the decks on the *Indefatigable's* trials for fear of straining the ship, while it is also said that the raised turret on the *Lion* is not intended for use in the axial line ahead and will only be fired on the beam.



Plan.

H M. Cruiser *Indefatigable*

The question as to which is the better arrangement for 12″ guns becomes thus even more complex. The *Indefatigable can* fire four to six guns ahead and actually six abeam; the *Lion* arrangement gives only two ahead in practice, but all eight on either broadside. Personally we fancy the 12″ gun is better placed as in the *Indefatigable* and the 13·5″ all on the centre-line. Certainly the increased blast over the decks from the latter weapon and the difficulty of sufficiently strengthening the hull-side to resist the recoil in offside firing, would put the *en échelon* distribution out of court for the *Lion*.

At present, however, it is unwise to accept all the rumours about the training arcs of the *Indefatigable's* guns as gospel. She is to undergo secret tests which will determine the possibilities of the system once and for all, and it is quite on the cards that she may prove equal to cross-deck firing. On the other hand, if she does not, it will mean that all foreign ships with their guns so placed will have their offensive powers curtailed to a similar degree.

As regards protection, the main water-line belt extends from bow to stern, is 8″ amidships from the bases of the fore to the after turrets and continued as 4″ to the bow and stern. The turrets are 10″ thick and the bases about 6″. A second armour strake extends along the main deck similar in thickness to that which protects the water-line. Details as to bulkheads and internal armouring are wanting. The ship has been built with the utmost secrecy, and actually very little beyond the figures given can be ascertained as to the system of protection adopted against torpedo attack.

Only two torpedo-tubes are carried, and these will discharge the new 21″ weapon. Some authorities give her four submerged and an astern tube, but this armament, we understand, is incorrect.

The *Indefatigable's* machinery consists of Parsons turbines of 45,000 I.H.P., supplied by Messrs. John Brown & Co., Clydebank, designed to give a speed of 26 knots, a speed which has already been exceeded by two knots. Steam is generated by Babcock boilers, and her coal supply is 1,000 tons normal and 2,500 tons maximum, plus oil fuel.

She was laid down at Devonport Dockyard in February, 1909, launched in October of the same year, and was due for completion last February. Her cost has been £1,547,426, while the cheapest of the 17,250 ton "Invincibles" cost £1,728,229!

In the following table she is compared with existing types of battle-cruisers:—

	Lion	*Indefatigable.*	*Invincible.*	*Von der Tann*	*Moltke*
Length over all	700′	580′	562′	561′	592′
Beam	86½	80	78½	87	88
Draught (mean)	27	26½	20½	26¾	26¼
Displacement (Normal)	26,300 tons.	18,750	17,250	18,700	21,500
Designed H.P.	70,000	43,000	41,000	41,000	68,000
Designed Speed	28 knots	26 knots	25 knots	25 knots	25 knots
Highest Speed		28 ,,	26·6 ,,	27·63 ,,	
Armour Belt	9¾″ Simpson	8″ Krupp	7″ Krupp	6″-7″ Krupp	6½″-7″ Krupp 8 or
Armament	8 13·5′	8 12″	8 12″	8 11″	10 12″
				10 5·9″	10 5·9″
	24 4″	16 4″	16 4″	16 4″	14 3·4″
Torpedo Tubes	5 21″	2 21″	5 18″	4 19·5″	4 19·7″
Coal ..	1000/3,500	1000/2,500	1000/2,500	1000/2,800	1000/2,800
Cost	£1,920,000	£1,547,426	£1,728,095	£1,853,000	£1,950,000
Cost per ton	£72·8	£82·5	£102·4	£98	£90·7

THE MCNAB DIRECTION INDICATOR.—We understand that a McNab direction indicator has been supplied to the *City of Baroda*, built for the Ellerman Lines, Liverpool, and recently launched at Whiteinch.

BRITISH INDIA COMPANY'S ENGINEERS' CLUB.

WE have pleasure in reproducing photographs of the interior of the British India Company's Engineers' Club in Calcutta which was founded over thirty years ago, and has been carried on with great success, proving itself a boon and a blessing to the engineers who trade to and from Calcutta, whether engaged in the coastal trade or the home line of the Company. Especially to the former is the club of great value as a social rendezvous, with its reading, sitting, recreation, refreshment and residential rooms. Many of those who were associated with its foundation have been referred to in our pages, on the occasion of their retirement from active service or on their departure from this life. The memories of such are kept alive by portraits in the club building. Many interesting functions have been held in the club, similar to one held in the beginning of May, the report of which has just reached us in time to refer to. The previous gatherings we have formerly commented upon were held in premises other and less elaborate than those illustrated, as the club has moved into new and improved quarters three or four times. The occasion now calling for comment was a farewell dinner given to Mr. J. L. Leslie, who has served the British India Company as Superintendent-Engineer in Calcutta, and is now on his way home for a well-earned holiday. Mr. R. A. Murdoch, Deputy Supt.-Engineer, occupied the chair and around him were representatives of the principal engineering and shipping firms in Calcutta. The loyal toasts were proposed by the chairman and received in appreciative terms by the company, after which Mr. Murdoch referred to his own personal experience and pleasant relationship with the guest of the evening, whose departure for home they had met to commemorate and to wish him a good voyage with a happy arrival at the end of it. Chief-Engineer Charles Mackay then proposed in felicitous terms the toast of the evening, commenting upon the able and characteristic way in which Mr. Leslie had discharged the duties of his office. He expressed in earnest language the high appreciation in which their Superintendent was held. The manner in which the toast was received showed a hearty endorsement on the part of the assembly. Mr. Leslie, in responding, expressed his thanks and the pleasure he enjoyed in the knowledge of the good feeling manifested, and for the kind wishes which had been conveyed to him. The toast of "Our Guests" was proposed by Mr. J. M. Macfarlane in kindly and pleasing terms, and responded to by Mr. Graham Robertson, Surveyor to the Indian Government, who added his personal acknowledgments of the worth and good points of the guest of the evening. The health of the chairman was proposed by Mr. J. W. A. Bell and duly responded to. The evening was enlivened by music and songs contributed by Messrs. C. W. Ives, A. McGregor, J. Skippers, J. A. Steveson, L. W. Hockley and W. S. Waddell.

At the close of the proceedings, hearty cheers were awarded to Messrs. Hunter and McLeod for the excellent arrangements which had been so well carried out under their convenership.

BRITISH INDIA COMPANY'S ENGINEERS' CLUB.

Entrance from Lift.

Drawing Room.

Reading Room.

Roof of Club.

Reading Room.

Billiard Room

A NEW DESIGN OF MERCHANT VESSEL.*†

By MAXWELL BALLARD, ESQ. A.M.I.N.A.

THE steamship *Edenor* being a new departure in merchant ship construction, it is hoped that a description of her, with particulars of the innovation in design and structure, may be of interest. The vessel has been built on the Ayre-Ballard principle for the Edenor Steam Shipping Company, Ltd., Newcastle-upon-Tyne, by Messrs. Osbourne, Graham & Co., Sunderland, and will be employed chiefly in the Baltic trade.

The order was secured in competition with other shipbuilders, who submitted proposals for vessels of the ordinary types, but the saving in first cost as well as the other advantages offered by the new design influenced the decision of the owners in placing the contract. The vessel was to have been completed early in December of last year; but, owing to the unfortunate stoppage of work in the shipyards caused by the lock-out of the members of the Boilermakers' Society, considerable delay occurred.

The following are the dimensions and leading particulars of the vessel:—

Length between perpendiculars	240 ft. 0 in.
" over all	249 ft. 9 in.
Breadth moulded	34 ft. 0 in.
" extreme	34 ft. 2 in.

Depth moulded, 16 ft. 5 in. + 5 ft. 9 in. arch erection.
Poop, 17 ft. 9 in. × 7 ft. Forecastle, 23 ft. × 7 ft.

She carries 2,141 tons deadweight on 16 ft. 0¾ in. draught with a block co-efficient of ·785, and has been classed at Lloyd's 100 A1, under special survey. The vessel is self-trimming, and has four hatchways of the following dimensions: Nos. 1 and 4, 24 ft. 11 in. by 21 ft. 6 in., No. 2, 29 ft. 9 in. by 21 ft. 6 in., and No. 3, 28 ft. 9 in. by 21 ft. 6 in. A smaller hatch is, in addition, fitted on the poop deck.

The propelling machinery fitted consists of triple-expansion engines with cylinders of 18, 29, and 48 in., with a stroke of 33 in., steam being supplied by two single-ended boilers, 11 ft. by 10 ft., working at a pressure of 180 lbs. This machinery will give the vessel a speed of 9½ knots at sea.

A general arrangement of the vessel is shown in Fig. 1. Reference to this figure indicates that so far as the longitudinal disposition of cargo holds, hatchways, general deck arrangements, and engine space are concerned, there is no departure from the ordinary design. The crew are berthed in a top-gallant forecastle of usual form, the poop erection providing additional cargo capacity. In the midship house immediately forward of the boiler casings is the saloon and sundry accommodation, while over this house is the captain's room, charthouse and flying bridge. Accommodation for the engineers and officers is provided at the casing sides, with galley and steering engine platform at the after end.

The constructional elevation and deck plan of the vessel are given in Figs. 2 and 3, and a midship scantling section in Fig. 4.

Considered up to the level of the normal moulded depth, as shown in the cross section, the hull is of usual form. From this position, and in lieu of the ordinary upper deck with bridge or continuous erection thereon, the upper structure takes the form of a composite transverse arch. The lower "corners" of this arch form the abutments, and the termination of, and support to, the vertical span of the flat side. The upper "corners" terminate the span of the deck platform, as will be seen by reference to Fig. 5. In the *Edenor*, as referred to later, a modification of this upper corner has been adopted. Usual camber is given to this deck, while the abruptly inclined portions of the composite arch, between the upper and lower corners, are convex for the purpose of practical construction.

The method of constructing this arch, as adopted in the *Edenor*, will be seen by reference to the cross section. The frames are continued up from the moulded depth line forming the arch ribs, and are cut at the beams, the latter forming elements of the horizontal component of the composite arch.

Considerations of deck area govern the method of junction at this position, and a variety of satisfactory connections is possible. In the *Edenor* the deck has been carried out beyond the limits of the upper corner, as shown by the cross section, and the opportunity afforded by this projection of fitting an ordinary beam knee connection to the arch side member, is taken. In the *Edenor* it will be observed that the beams have been extended for this purpose.

The outside shell plating has been carried round the arch, the top strake being flanged back in the manner indicated, and connected to the stringer plate by a bar. This method is not essential, and, if dispensed with, no detriment to either the structure or the principle involved would result. In this bar connection special care has been taken. The rivets are spaced 3¾ in. apart, zig-zag, and are ⅞ in. in diameter fore and aft. The beams and half beams have been fitted as usual.

Many equally efficient modifications of the methods of constructing the arch present themselves. For example, the frames could be cut and scarphed or bracketed at the lower abutment, while bracket plates could be substituted for the half beams. The course adopted in the *Edenor* commended itself in that it reduced to a minimum the number of structural members.

Webs of the form shown on the cross section are introduced. Additional stiffening of the arch sides and extra support to the deck platform have in this way been provided, and the composite arch form has been reinforced at regular intervals. The spacing of these webs in the *Edenor* is shown on the profile. At the hatch ends the arched webs are combined with the hatch-end coaming plates, the whole constituting a complete arched web, extending from abutment to abutment. A reverse bar, extending from the tank side to the deck, is fitted to each of the webbed frames, and, in the case of the hatch ends, this reverse bar is carried from the tank side round the arch continuously to the opposite tank side.

With the addition of a stringer fitted at the base of the arch—tying the frames and connecting the webs and bulkheads—the construction of the composite transverse arch is complete. The structure and form described, in conjunction with girders and brackets under the beams on the centre line obviate the necessity of pillaring. The very clear holds thus afforded have greatly impressed those who have inspected the *Edenor*.

Referring to the elevation, it is seen that, in combination with this transverse arch, a longitudinal camber has been adopted. The moulded depth knuckle line has been maintained at the midship level forward and aft until merging into the form of the vessel in the proximity of the poop and forecastle. By this means the vertical frame span is not increased towards the ends as is usual in ordinary vessels. It must be admitted, however, that for both cases the strength due to form o

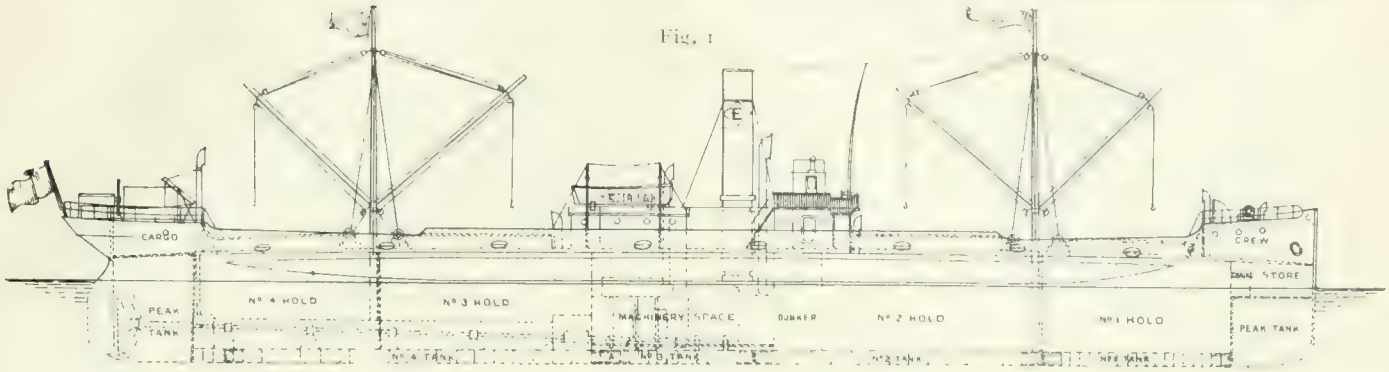
* Read at the Spring Meetings of the Fifty-second Session of the Institution of Naval Architects, 1911.

† We have pleasure in publishing the following statement, which shows the final results of the design as compared with the figures given by Mr. Maxwell Ballard, the designer previous to the signing of the contract for building:—

(1) The actual Invoiced weights of Steel materials in the *Edenor* came to ¼ ton less than given to the Builders by Mr. Maxwell Ballard.
(2) The final deadweight came to within 1 ton of that estimated.
(3) The draught came to within ¼″ of that designed for.
(4) The hold capacity given was 112,200 cub. ft. and the actual capacity 112,000 cub. ft., being practically the designed figure.
(5) The nett tonnage was given as 808, and the final 812.

When it is remembered that the vessel is the first of an entirely new type, the above figures probably constitute a record of close designing and estimating on the part of the naval architect, and form a tribute to the thorough knowledge of every feature of design of vessels possessed by the designer of the *Edenor*.

Fig. 1



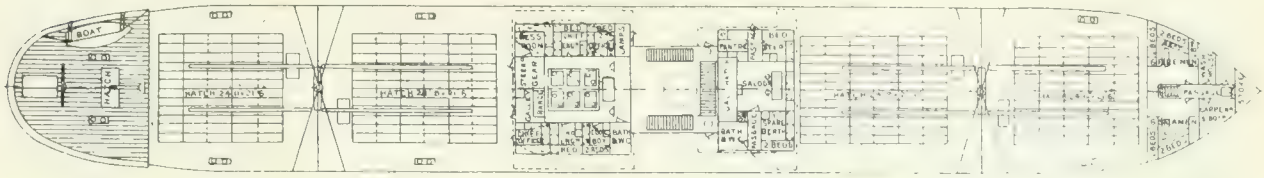


Fig. 2.

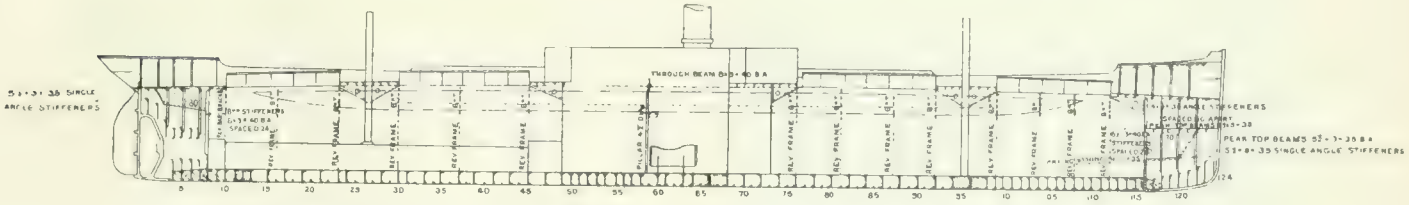
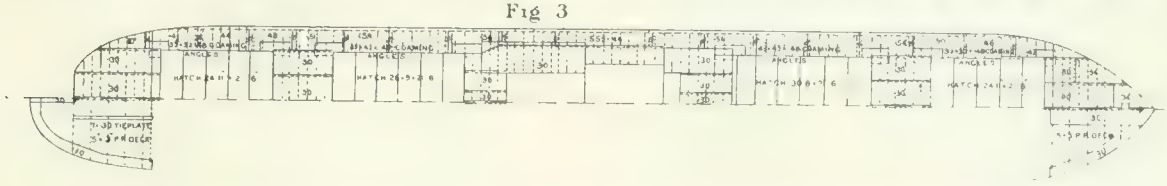


Fig 3



S.S. *Edenor*.

Length B.P., 240 feet. Breadth Mld., 34 feet. Depth Mld., 16 ft. 5 in. + Arch 5 ft. 9 in.

the round sections forward is probably underrated, this being a virtual reduction of the vertical span. At the upper "corner" the midship depth of knee is retained fore and aft, and in consequence the bevel of the deck projection towards the ends assumes practically the vertical.

Longitudinal camber has been suggested previously, and the theoretical advantages and practical disadvantages being so well known, it is only necessary to here point out how the latter have been overcome in the present design. It should be stated, however, that camber is not essential to the design, and the straight, or even usual sheer may be adopted if preferred.

Owing to the increased height of deck platform afforded by the transverse arch, the camber does not bring the weather deck level below the ordinary deck sheer line. From Fig. 6 it is obvious that the lowest point of the exposed deck in the new design approximates to the highest point in the ordinary "Three Island" vessel, the poop and forecastle erections being practically identical. If this reverse sheer were not applied, and the arch deck were carried straight to the ends of the vessel, the poop and forecastle would be higher above water than in the ordinary type of vessel by the difference between the arch depth and the sheer at any position. Sheer, as adopted in modern vessels, is contrary to the original function of sheer, and is mainly an unscientific method of obtaining unpenalized draught.

The *Edenor*, as already mentioned, has been constructed to Lloyd's requirements, and her scantlings are given in Fig. 4. In obtaining the transverse numerals, the depth is taken to the normal moulded depth line as usual, an allowance being made for reverse sheer, the depth for proportions being the total depth to the arch deck. The scantlings, however, were specially discussed, and the author's thanks are due to the authorities of Lloyd's Register for the consideration and valuable assistance given.

The practical construction of the *Edenor* presented no difficulties, there being little departure from the ordinary methods of building. In the frame turning a clear knuckle line has been obtained at the moulded depth, and, though turned at both bilge and top, only one heat was required. Naturally, a slightly longer time was taken to turn the bars, and three shillings per pair extra cost was incurred. The absence of sheer enabled the shell plating to be utilised in connection with ribbanding.

The primary object of the Ayre-Ballard design is economy of structure. The obvious necessity of taking advantage to a greater extent of the strength due to form, if further economy in structure was to be obtained, gave impulse to the development of the arch form. Ship design is of necessity a compromise, the conflicting elements of which render it most difficult to arrive at a satisfactory solution of the problem. Broadly speaking, in the successful cargo carrier this compromise must be represented by a combination of minimum initial cost and minimum cost of running and maintenance, with maximum carrying power and the requisite strength and stability.

In the Ayre-Ballard design economy is obtained by the redistribution of material. With less surface of material, on the same dimensions, an increase in reserve buoyancy is obtained, and thereby of draught. Maintaining a given draught, the depth of vessel may be reduced. On the more correct basis of the same deadweight on the same draught and speed, very considerable saving is obtained. Economy of construction must be qualified by a satisfactory compromise

	Edenor	Single Decker. Three Island Type	Raised Quarter Decker.
Dimensions—Moulded	240 ft. × 34 ft.	240 ft. × 34 ft.	240 ft. × 34 ft.
Displacement	2,957	2,957	2,957
Draught and Block-Co-efficient	16 ft. 0¾ in., ·785	16 ft. 0¾ in., ·785	16 ft. 0¾ in., ·785
Machinery—Weight in tons	150	150	150
Deadweight (tons)	2,141	2,055	2,066
Net Tonnage	812	784·8	798·0
Capacity in Cubic Feet	112,000	103,860	105,240
Deadweight ÷ Tonnage	2·64	2·62	2·586
Capacity ÷ Deadweight	52·6	50·52	50·93
Total Invoiced Materials	594½	680¼	674
Excess of Material, tons	—	85¾	76
Deadweight ÷ Displacement	·724	·695	·698

TABLE I.

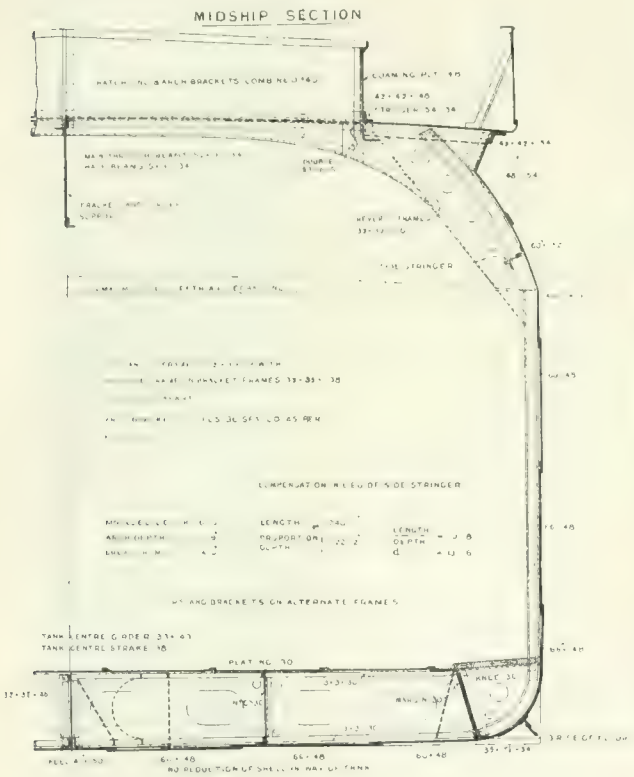
Type	No. 1. Single Deck with Short Bridge.	No. 2. Single Deck with Long Bridge.	No. 3. Ayre-Ballard.
Dimensions	L. 348 ft. B. 48 ft. 3 in. D. 27 ft. 4 in.	L. 345 ft. B. 49 ft. D. 25 ft. 4½ in.	L. 338 ft. B. 47 ft. 3 in. D. 24 ft. 8 in.
Erections	Poop 23 ft. F'cle 25 ft. Bridge 118 ft.	Poop 23 ft. F'cle 25 ft. Bridge 231 ft.	Poop 23 ft. F'cle 25 ft. Arch 7 ft. 6 in.
Displacement	8,608	8,657	8,188
Draught and Block-Co-efficient	22 ft. 6 in. at ·80	22 ft. 6 in. at ·80	22 ft. 6 in. at ·80
Machinery weight, tons	365	365	340
Bunkers, tons	455	455	405
Cargo, deadweight, tons	5,839	5,849	5,842
Net Tonnage	2,463·1	2,228	2,471
Capacity, cubic feet gross	374,805	363,860	347,111
Deadweight ÷ Tonnage	2·32	2·56	2·36
Capacity ÷ Deadweight	64·81	62·83	60·74
Deadweight ÷ Displacement	·731	·728	·762
Strength Modulus	9,500	8,775	8,540
Total Invoiced Materials	1,878¾	1,912¼	1,517
Excess of Materials, tons	361¼	395¼	-

TABLE II.

with what may be termed the commercial elements, these latter being controlled mainly by dimensions. Large capacity and low nett tonnage are opposing elements, but a good deal may be accomplished in the direction of combining the two. In the arch design the erection, while providing increased hold capacity, so increases the volume in the propelling space as to enable the $1\frac{3}{4}$ allowance to be readily obtained for moderate sized steamers.

A comparison of the Ayre-Ballard design, as illustrated in the *Edenor*, with steamers built to the ordinary designs, is given in the No. 1 table all the vessels therein being on the same basis of specification exactly.

Fig. 4



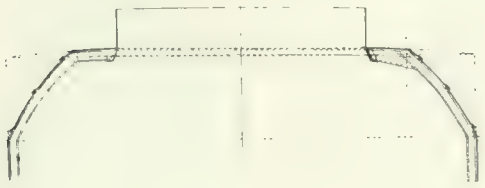


Fig. 5.

This comparison shows advantageously for the *Edenor* in first cost, deadweight carrying power, and capacity, although the ordinary vessels are popular types with owners of tramp tonnage of moderate dimensions.

The material saved is about 12 per cent. in the above cases. This, however, increases as the dimensions are enlarged, there being more scope to bring into operation the elements of the design.

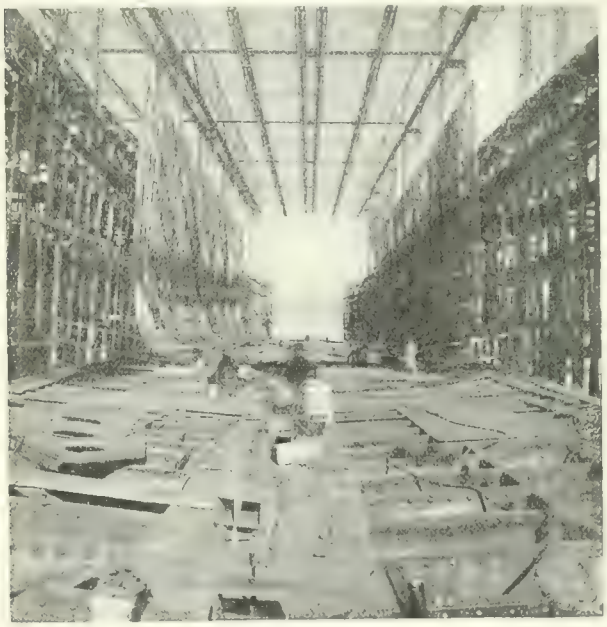
The foregoing comparison is based upon similar dimensions; the more correct basis is upon the same deadweight and the same draught and speed. In order to illustrate this, a further comparison (No. 2) is given below, the vessels being again upon identically the same basis and specification. It should be added the estimates are based upon No. 1 vessel of the comparison, and are therefore strictly comparative.

(To be continued.)

THE "EUROPA."

The Building of the world's Largest Vessel.

FOR some months there has been in course of construction in the shipbuilding yard of the Stettin "Vulcan" at Hamburg, an ocean steamer which will be larger than any other ship constructed hitherto in Germany or elsewhere. This mammoth vessel is being built for the Hamburg-America Line, who intend to develop their Hamburg-New York service with the vessel now under construction. The illustration shows the present stage of construction and will indicate how rapidly progress is being made. It is expected that the launch will take place in the spring of 1912. The vessel will be 881 feet in length by 100 feet in breadth, and of 50,000 tons gross. 327 ribs are being placed in position on each side of the vessel, the longest of these being 26 metres, and weighing 1500 kgs. each.



Building the *Europa*

STABILITY INDICATOR FOR SHIPS.

THE proprietors of the Patent G.M. Balance or Stability Indicator, of 21 and 22, Broad Street House, New Broad Street, London, E.C., have sent us an illustrated pamphlet dealing with their Stability Indicator for ships. Full particulars are given of the instrument, the simplicity of which is one of its principal characteristics. By the use of the Indicator the safe or unsafe condition of a ship in relation to stability can be determined at any moment and under any condition of loading, either actual or proposed. It enables the storage of cargo to be so arranged in vessels that maximum loads and minimum of water ballast may be carried on every voyage, combined with the best possible conditions of seaworthiness. A number of letters from responsible firms and persons testifying to the accuracy and utility of the instrument are included in the pamphlet.

MESSRS. SWAN, HUNTER & WIGHAM RICHARDSON'S "TOILER."

Diesel-Engined.

MUCH has been written of late about vessels of varying sizes which are driven by Diesel oil engines. As a matter of fact the number of oil engine propelled sea-going vessels probably does not, as yet, number more than two or three, and by far the largest of these is the *Toiler*, designed and built by Messrs. Swan, Hunter & Wigham Richardson, Ltd., at their Neptune Works, and which has recently completed a voyage from the Tyne to Calais and back.

About twelve months ago, after careful investigation and consideration of various types of engines, oil, gas, electric and others, Messrs. Swan, Hunter & Wigham Richardson, Ltd., decided to build a vessel suitable for special service on the Canadian canals and lakes, and to fit her with two sets of Diesel oil engines. The speed on the canals is limited so that engines of relatively small power were sufficient to meet the requirements.

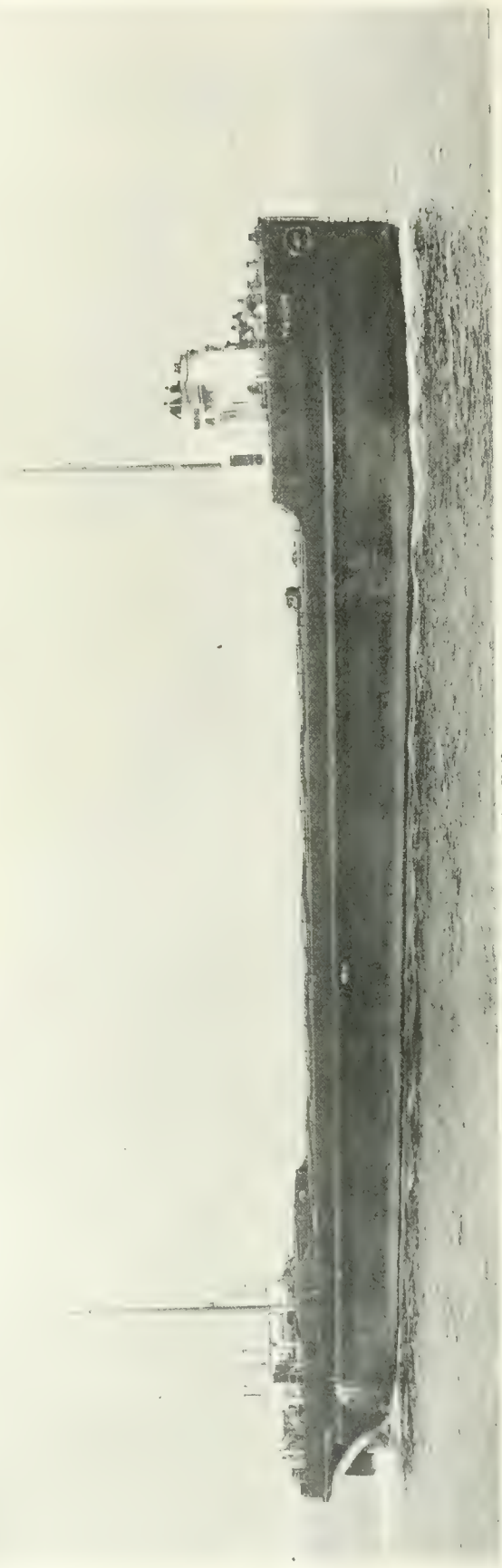
The *Toiler* is a twin-screw vessel 248 ft. between perpendiculars by 42½ ft. beam by 19 ft. depth moulded, and is propelled by two sets of two-cycle reversible Diesel engines of a combined B.H.P. of 360, equal to about 400 I.H.P. working at about 250 revs. per minute. These engines were supplied by the Diesel Motor Co., of Stockholm, and were fitted on board by Messrs. Swan, Hunter & Wigham Richardson, Ltd., at their Neptune Works.

On her voyage to Calais the *Toiler* was loaded with 2,650 tons deadweight of coal cargo besides about 40 tons of oil fuel, fresh water and stores, a total deadweight of nearly 2,700 tons on a mean draught of 14 ft. She left the Tyne in very rough weather, notwithstanding which the engines worked perfectly satisfactorily. The voyage to Calais was completed at an average speed of 5·9 knots (or 6¾ miles). On her return voyage, light in ballast, the average speed was 8·2 knots (or 9½ miles). The consumption of oil fuel for the round voyage including auxiliary compressor was 6½ tons, say 1·65 to 1·75 tons per day.

In many ways the *Toiler* is more economical than a steam-driven boat. She has a greater dead weight capacity owing to the fact that the Diesel engines are much lighter than steam engines and boilers, the weight of these being about 60 tons; the cubic capacity for cargo is also greater as the boiler space is saved and the oil fuel can be carried in the double bottom in place of water ballast, thus saving bunker space.

The oil consumption is much less in weight than the consumption of coal for steam engines. In the *Toiler* the consumption at full speed does not exceed 1·75 tons per day of fuel oil of 81,000 B.T.U. calorific value, whereas with steam engines of equal power the consumption of coal would not be less than 8 tons per day. The actual difference in cost depends, of course, upon the relative prices of coal and oil in the district where the vessel is trading.

Not only is the economy of this vessel shown in the increased deadweight of cargo carried, the increased cubic capacity and the low fuel consumption, but the staff on board to attend to the Diesel engines is less



The *Toiler*.

than the staff required for steam engines and boilers, the engine room staff being about the same, whilst firemen are not required.

The deck machinery and engine-room accessories of the *Toiler* are driven by compressed air, which is furnished by a compressor driven by a small Diesel engine. The electric light, with which the vessel is fitted, obtains its power from a small paraffin engine. The accommodation is heated by hot water, and the heat is obtained either from the exhaust gases of the main engine or by means of a coal fire. There is thus no steam on board the boat.

Messrs. Swan, Hunter & Wigham Richardson, Ltd., have now taken up the construction of marine Diesel oil engines in their Neptune Engine Works, and have at present a set of four-cylinder two-cycle engines in hand.

CANADIAN SHIPBUILDING.

THE Dominion of Canada having determined to have a navy of its own, and of its own construction, are facts which have naturally been noted with interest by Clyde shipbuilders and artisans, and the feeling is that the change will not have the effect of contributing to the volume of Clydeside industry. This is heightened by the prospect of the shipyards about to be established on Canadian shores undertaking mercantile shipbuilding as well as naval; but before this stage of development is reached, the Clyde, and other centres probably, will have been drawn upon largely for the wherewithal in experience, administration and labour —thus constituting simply a transference of the venue of industry. The British-Canadian Shipbuilding and Dry Dock Co. has been incorporated by Dominion charter, and is about to establish plant at Sydney, Nova Scotia. The Dominion realized that the unrivalled skill, experience and resource of the United Kingdom must be identified with the project, in order to lay the foundations of a great, new industry and to ensure its success. The new company, therefore, which has been incorporated at Ottawa with a capital of 10,000,000 dollars, is a combination of British constructional interests with Canadian enterprise. The former are represented by the Fairfield Shipbuilding and Engineering Co., Govan, and John Brown & Co., Clydebank. The two companies are famous as builders of battleships for the British Navy, as well as of first-class passenger and general trading steamers, and share, moreover, in the control of the Coventry Ordnance Works. It is the intention of the Canadian Shipbuilding and Dock Co., with the co-operation named, to instal at Sydney what will probably be the largest shipbuilding plant in either Great Britain or America. The buildings, way-slips, and docks will cover 125 acres, and it is proposed to acquire 200 acres more, for future extension, if necessary. The associated companies believe that within six years they will be able to make the largest ordnance now required for Dreadnoughts even to the 13·5 guns. In connection therewith they will be able to make all mounts, turrets, armour-plate and everything necessary for the complete output of modern battleships. The dock will be 1000 ft. long, 110 ft. wide and 45 ft. deep on the sill at high water. It seems an arduous undertaking for the companies concerned to build a plant of such large proportions within six years, but as they have signed a contract to do so, they must have faith in their own ability. Indeed, actual tenders for the building of the first ships for the Canadian Navy have been sent in to the Dominion Government. It will require a force of 2000 to 3000 workmen for the next three years to build the docks and shipyards, and when complete the works will employ from 5000 to 8000 men.

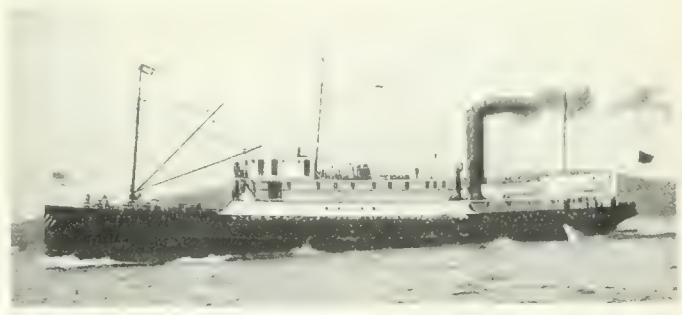
HAWTHORN'S MARINE ENGINEERING ACADEMY.—At the examination held in London in April last for the extra 1st engineer's certificate, one of the successful candidates was Mr. W. McDonald, who was a student of Hawthorn's Engineering Academy, 41, East India Road. Mr. McDonald makes the third success in this examination during the present year from this old-established school.

FROM WELL-DECK COASTER TO MAIL AND PASSENGER STEAMER.

TO take over an ordinary well-deck coaster and in a short time and with comparatively small expenditure —of money, that is, not of ingenuity and skill—convert it into a mail and passenger steamer, with accommodation equalling in many respects that usually found only on board high-class liners, constitutes work worthy of note. The *Prince John*, which on May 17th left the Clyde for Vancouver, was, until quite recently, the *Amethyst*, one of the well-known fleet of coasting steamers belonging to Messrs. Robertson (Gem. Line), of Glasgow. Acting for the Grand Trunk Pacific Railway, Captain S. F. Mackenzie, selecting the *Amethyst* as a capable subject of transformation, designed the main

The *Amethyst*.

features of change and superintended the work of carrying these out at the hands of Messrs. A. Rodger & Co., shipbuilders and ship-repairers, Port Glasgow. The vessel, as the *Amethyst* and as the *Prince John* is illustrated herewith from actual photographs. The converted vessel, although having little done to her original engines, ran speed trials over the measured mile shortly before leaving for Vancouver, and attained a speed of over 11½ knots. She is to be engaged on the mail and passenger service of the Grand Trunk Pacific Railway Co. between Prince Rupert, the terminus of the railway, and the Queen Charlotte Island ports. The principal particulars of the steamer are as follows:—Length b.p., 185 ft.; breadth, 39 ft. 6 in.; depth, moulded to quarter



S.S. *Prince John* ex *Amethyst*.

deck, 17 ft. 3 in., having a gross tonnage of 904 with a nett registered tonnage of 539 and a deadweight carrying capacity of 800 tons. The steamer has been fitted with a large deck-house about 70 ft. long, having accommodation for fifty-two first-class passengers in two-berth state-rooms. The central part of the deck-house is fitted up as a lounge, with an observation room at the fore end, handsomely furnished and decorated in white and gold, with large plate-glass windows in front. The dining saloon extends the full width of the steamer on the main deck and provides ample accommodation for dining all the passengers at once. Adjacent to the dining saloon is a large pantry and galley. A deck-house has been fitted on the deck aft with accommodation for a few first-class passengers with room at fore and having a complete

installation of wireless telegraphy by the United Wireless Co. An after 'tween deck has been fitted for the accommodation of about 200 steerage passengers with entrance from main deck. The captain's and officers' rooms are in a steel deckhouse on top of promenade deck, with chart-room and wheelhouse in front, the crew being berthed in the lower forecastle forward and engines aft. The passengers' and crews' accommodation throughout is heated with steam radiators. The steamer has a complete installation of electric light fitted in the accommodation, also for navigating the ship and cargo clusters for discharging. A powerful searchlight is fitted on the top of the wheelhouse. Two steam winches are fitted at the forward hatchways with large derricks for the rapid handling of cargo. A large steam windlass is fitted on the forecastle deck for lifting the anchors, and a steam capstan aft for working the steamer.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(From our Own Correspondent.)

Portsmouth Dockyard.

THE battleship *King George V.* is making headway rapidly; indeed, her construction is much more advanced than the *Orion* was after she had been in hand for the same period. The vessel will, however, not be launched until September. As to the *Orion,* she will be shortly ready—probably during June—to carry out her steam trials. The repairs to the battleship *Superb* have been completed, and she has rejoined the Home Fleet at Portland. The *Dreadnought,* which is in No. 15 dock, is to be completed by June 10th, so that she may rejoin the Home Fleet for the review. Work on the armoured cruiser *Drake,* for whose refit the sum of £100,000 is allowed, will shortly be suspended until after the review The armoured cruiser *Roxburgh* is also in dry dock undergoing a partial overhaul. The destroyers *Gipsy* and *Fawn* have been paid off and taken in hand for refit. The *Roebuck* has completed her refit and has been commissioned for the local destroyer flotilla. Another of our destroyers, the *Shark,* a vessel seventeen years old, has been removed from the effective list, and will shortly be sold. For some time past we have been short of two docks, No. 10 dock caisson having been undergoing repair in No. 11. The repairs have now been completed, and the two docks are again available for ordinary repair work. The old *Victory* is undergoing a partial overhaul at her moorings. Her rigging has been replaced and in various ways the vessel is being smartened up in readiness for the large number of visitors during the Coronation review. The *Victory* gets more popular with visitors each year. The remarkable story of the buckling of the *Invincible,* which was published in a London daily paper, caused a good deal of trouble, as the Admiralty insisted on a strict and searching investigation. The *Invincible* is quite serviceable both as to hull and guns, but in the case of two of the barbettes the electrical mechanism does not give complete satisfaction, and during the refit of the ship this is to be overhauled. On May 10th, the Duchess of Albany paid a visit to the port for the purpose of presenting to the battleship *Neptune,* the flagship of Admiral Sir Francis Bridgeman, the Commander in Chief of the Home Fleet, a silk ensign, which Her Royal Highness herself had worked. Captain De Bartolomé and the principal officers of the vessel were presented to the Princess, who afterwards hoisted the ensign. The four hulks which form the torpedo schoolship *Vernon* will shortly be taken back to their berths at the entrance to Fareham Creek, they having been moored for some time in Fountain Lake, as it was necessary to carry out extensive dredging at the entrance to the creek, and all the Vernon's moorings had to be taken up. The cruiser *Glasgow* has left for the East Coast of South America to relieve the *Amethyst.* Shortly before leaving for her new station the *Glasgow* went to Glasgow to receive a presentation of plate from the Corporation and citizens. Some interesting firing exercises took place on May 5th, Submarine *A1* being fired at while submerged and sunk at the eastern entrance to Spithead with a view to testing the effect of lyddite shell on such craft. The vessel, which was eight or ten feet under water, and was fired at from a torpedo gun boat, was subsequently raised and docked for examination.

Devonport Dockyard.

Good progress continues to be made with the construction of the battleship *Centurion* and the cruiser *Lion,* notwithstanding that we have had a large amount of repair work in hand. The *Centurion,* which has been under construction three and a half months, has been advanced to about 50 per cent. of her launching weight, so at this rate she should be ready to take the water in September. Sir Philip Watts, the Director of Naval Construction, paid us a visit on May 16th, and inspected the vessel. The *Lion* is to be ready for the pennant in November, and work on her is in a very satisfactory condition in all departments. The battleship *Temeraire* is undergoing a refit. An examination of the bilge plating showed that she escaped injury during her passage into Ferrol Harbour, when the *Collingwood* touched a rock. The cruiser *Æolus* has had her defects put right, and has been commissioned to replace the *Scylla* on the North America and West Indies station. The latter vessel has returned home. The cruiser *Bristol* has also been completed and she has since been to Avonmouth, where a presentation of plate was made on behalf of the citizens of Bristol. The destroyer *Kennet* has been sent to Pembroke for a refit, and the gunboat *Gossamer* has gone to Invergordon, to temporarily replace the *Ringdove* on fishery duties. The cruiser *Warrior* is still in hand. The lengthening of her fore funnel last year having been found to be an improvement, it has been decided to lengthen the other two, and the work is now in progress. The battleship *Commonwealth* is to leave here early in June to join the Nore Sub-Division of the Home Fleet. She is the second of the "King Edward" class to be relegated to the Third Division of the Home Fleet, in which the *Africa* is now serving, the other vessels being at present in the Second Division. The *Commonwealth* has been a somewhat unfortunate vessel, and it is probably as a result of the damage she has sustained from time to time that she has been put down after such a short career. It is only six years ago since she was first commissioned. Two of the vessels of the Devonport Destroyer Flotilla, the *Arab* and *Leopard,* were damaged while manœuvring at the end of April off the Isle of Skye. They were taken to Greenock for repairs. One of the vessels had a large hole in the starboard side, while the other had her bows so badly damaged that she had to be beached for temporary repair. A wooden bow was fitted to stop the inrush of water and make the vessel navigable. The accident took place during night operations.

Chatham Dockyard.

Our new cruiser the *Chatham,* which is being built under the superintendence of Mr. E. R. Bate, senior constructor, is making exceedingly satisfactory progress, and there is no doubt that she will be ready to take the water by the beginning of August, and possibly earlier. The date provisionally fixed for her completion is the end of August of next year, but if necessary she could be completed much earlier than that. In these days eighteen months for the completion of a vessel of her size is very slow work, but the rate of progress is fixed by the Admiralty, and we can only do as we are ordered. The cruiser *Hyacinth,* the late flagship of the East Indies Squadron, has arrived to be paid off. She is to be taken in hand for a thorough refit at a cost of £60,000. The *Hyacinth* has lately been engaged in the suppression of gun running in the Persian Gulf. Her last affair, that at Dibai, was quite a small battle. The cruiser *Scylla,* which has been serving on the North American Station, has also arrived to pay off and refit. She is being relieved by the *Æolus* from Devonport. The battleship *Implacable* came in to pay off and recommission for further service in the Atlantic Fleet. The vessel was only recently refitted at Gibraltar and there was no need for her to make a lengthened stay. We have had quite a number of obsolete cruisers of late years to convert into depot ships, mine layers, and so forth. The policy of doing so is to be commended, as many of the vessels are now capable of good service. The *Pactolus* has recently been brought in to be converted into a depot ship for submarines. She was completed just over twelve years ago, but was in commission only five years,

and for several years past she has been lying in the River Stour. At one time she was ordered to be sold, but the order was withdrawn. The cost of her conversion is estimated at about £12,000, so she will be a cheap depot ship. Other vessels in dockyard hands are the battleship *Dominion,* the cruisers *Boadicea, Cressy,* and *Dido,* and the destroyer *Eden.* The *Leviathan,* the flagship of the Fourth Cruiser Squadron, is out of hand. Engineer Commander Rawlingson has succeeded Engineer Rear-Admiral C. Rudd as engineer manager, the latter officer having retired from the service. He was most popular with the subordinate officers and men of his department, who gave him a most hearty send off.

Sheerness Dockyard.

It is to be regretted that when the yard was adapted for the repair of torpedo boats and destroyers No. 3 Dock was not lengthened in the same manner as No. 4 and No. 5 were. The question of lengthening the dock was raised again some time ago, but it appears to have been shelved. If we were able to use No. 3 Dock for the latest type of destroyers we could cope with all the vessels of the First Flotilla, instead of which they have to go to Chatham. The Nore Destroyer Flotilla is rapidly being transformed by "River" vessels being added to it as they are replaced in the Second Flotilla by the new ocean-going destroyers. The *Boyne* has paid off from the Second Flotilla, following on the delivery of the new destroyer *Minstrel* from the works of Messrs. Thorneycroft & Co., and the *Liffey* has also been commissioned for the Second Flotilla on being relieved by the *Nymphe,* from the works of Messrs. Hawthorn, Leslie & Co. The *Exe, Arun* and *Itchen,* now in the Second Flotilla, are also under orders to join the Nore Flotilla, has been paid off and placed in dockyard hands nine vessels of the "River" class in the flotilla. Five of them are, however, to go shortly to the Mediterranean, the *Colne, Chelmer, Garry, Jed,* and *Welland.* These vessels have been ordered to relieve the *Ardent, Banshee, Boxer, Bruizer,* and *Dragon.* When the latter vessels return home there is little doubt but that they will be placed on the sale list. The *Usk,* of the Nore Destroyer Flotilla, has been paid off and placed in dockyard hands for a refit, her crew proceeding to Devonport to join the *Dee,* which has been commissioned for the Nore Flotilla. The torpedo-gunboat *Speedy,* which had been in hand for five months undergoing a thorough overhaul and repair at a cost of over £13,000, has been completed and has resumed duty in the Nore Division of the Home Fleet. Other vessels in hand refitting are the destroyers *Test, Snapper,* and *Express,* the special service vessel *Elfin,* Submarine *C9,* and Torpedo Boat No. 28. Torpedo Boat No. 068 has completed her refit, and has gone to Portsmouth to take up duty as tender to the *Victory.* Torpedo Boats Nos. 33 and 34 have also completed their refits and rejoined the Nore Flotilla. The steam trawlers *Seamew* and *Seaflower* have completed their refits and on May 17th left with the *Sparrow* and *Spider* and the special service vessel *Rose* for Grimsby for the training of the officers and men of the Trawlers' Section of the Royal Naval Reserve. The vessels will be under the orders of the commanding officer of the torpedo gunboat *Circe.*

Pembroke Dockyard.

The cruiser *Blonde,* having completed the acceptance trial of her propelling and other machinery, returned to receive the finishing touches to the hull, and on May 11th she was commissioned for temporary service with the First Destroyer Flotilla, which she has left to join. She was commissioned seventeen months and a half from the date she was laid down. The cruiser *Active* is making good progress. Her mast has just been lifted in and stayed in position; it is a long wooden spar, and will carry a lofty topmast with yards for wireless telegraphy. A gang of about twenty-five shipwrights has been taken off the vessel to commence work on the first of the two battle-practice targets which we are to construct. The cruiser *Amphion* is also making very satisfactory headway, the keels having been laid the full length of the ship and the stern post and stem being in place. The frames for almost half the length of the vessel have been erected to the full height and all the beams of both the lower and upper decks have been crossed for that distance. In the fore part the work in the interior is making good progress, and the plating of the inner and out bottoms and of the lower deck is proceeding. The refit of the destroyer *Coquette* has been completed, but at the time of writing the three hours' full-power commissioning trial has not been carried out, although two attempts have been made. The first failed because of the bursting of a boiler feed pipe, while the second was abandoned owing to a leakage of steam from the joints of some of the pipes. Both failures are attributed to the unusual degree of vibration caused by working the engines at full power. The vessel was dry docked on May 15th, when it was found that pieces had been broken out of five of the six propeller blades, and that the sixth had been bent. This was probably caused by the vessel striking some floating wreckage on her last trial. It is open to question whether a vessel like the *Coquette,* which is twelve years old, is worth the cost of a thorough repair refit. The *Coquette* was commissioned by the crew of the *Kennet,* which has arrived from Devon port for a thorough repair refit, including the retubing of her boilers. The *Kennet* on her passage here ran nineteen knots an hour until nearing the coast, when her speed was reduced to sixteen knots. The vessel was built by Messrs. Thornycroft & Co., and completed in 1904-5. We have recently had a visit from Mr. J. B. Marshall, the Director of Dockyards, who inspected the *Active, Blonde* and *Amphion,* and also investigated the circumstances having relation to a new boiler-makers' workshop which is to be built so as to better equip the yard for carrying out the refits of destroyers and other small craft. The contract for the new patent slip for destroyers which has been authorised to be constructed has not yet been placed.

LAUNCH OF THE "CONQUEROR."

The Clyde's Record Naval Production.

THE battleship *Conqueror* was launched in the presence of a large concourse of spectators from the Dalmuir Works of Messrs. William Beardmore & Co., Ltd., on May 1st. The *Conqueror's* keel was laid on April 4th of last year, and she has thus been about thirteen months on the stocks. Her construction was hindered considerably by the lock-out of ironworkers in the autumn and winter of last year; and although somewhat late of being sent afloat, her interior constructional work and equipment are matters well advanced; and there is every likelihood that she will be completed before the date stipulated by the Admiralty, 1st April, 1912. All her boilers are on board, and a large amount of her armour is in position, her weight at launching having been close on 11,000 tons. With her hull in finished condition displacing 22,500 tons, and her machinery to develop 27,000 I.H.P., giving her a speed of 21 knots, and with a main armament of ten 13·5 in. guns in pairs on the middle line, she is the largest and most powerfully armed warship that has, so far, been built on the Clyde. Comparing her with the *Agamemnon,* the immediately preceding battleship launched from the Beardmore works five years ago, the *Conqueror* is 135 feet longer, 10 feet less beam, and the launching weight was 50 per cent. greater. Comparing her with the *Colossus,* launched a year ago, by Scott's Shipbuilding and Engineering Company, Greenock, she is larger and more strongly armed than the latter. Her designed speed is the same, although the shaft horse-power of her turbines is greater. There is not much difference in the armour protection of the two vessels, and the principal advance in the case of the *Conqueror* is in the size and disposition of her heavy guns. The *Conqueror* has been launched on the date stipulated by the Admiralty.

LAUNCH OF THE NAVAL AIRSHIP AT BARROW.

[From our Own Correspondent.]

THE naval airship built by Messrs. Vickers, Limited, for the Admiralty was successfully launched at Barrow on Monday morning, the 22nd of May. The event had been expected for some time, but it was found necessary to make improvements and alterations almost every day, and certainly every week, in order to assure all the greater success when the launch took place. These were made under the control of Captain Sueter, who has had much experience in aviation and in the construction of submarines at Barrow, and also the Advisory Committee of the Admiralty. This is the first airship built for His Majesty's navy, and is, of course, the biggest experiment yet made. The designs were thoroughly well considered by experts before the work of construction was determined on, and after the vessel was partially built, new ideas were adopted, which helped to prolong the time of building operations.

It was officially known that the airship would be launched on the 21st of May, and great crowds gathered to see the interesting event, but it was found impossible, owing to an unfavourable wind, to launch the ship until the following morning, as some difficulty was anticipated in getting the vessel out of the shed in which she has been built. It was worth while causing the delay, because on Monday morning there was no breeze at all, and the work of floating the ship out of the shed was commenced just at dawn. She was easily moved by the help of marines from the guard ship, H.M.S. *Hermione*, who pulled her out into the open with the utmost facility. Much interest was taken in the vessel because of the great secrecy which has been observed as to the features of her construction. The firm were charged to secrecy, and navy men for months have guarded the ship to prevent prying eyes from seeing her or from getting information which might be used.

The immense size of the shed in which she has been built has afforded sufficient proof of the fact that the vessel, when brought out into the light of day, would be of ponderous dimensions. Full assurance of this fact was given when she majestically glided into the waters of the Cavendish Dock, which is used only for the purposes of airship construction and airship manœuvring. This dock has a water area of 200 acres, and is admirably adapted for the purpose. The vessel, when free from the shed, was taken in tow by a small pinnace and towed to a mooring buoy in the centre of the dock, where she displayed her vast proportions of admirable symmetry. It only took ten minutes to get the dirigible out of the shed, and this was done without the slightest accident amid the cheers of the crowd which had assembled on the sides of the dock. She floated on the water apparently motionless supported by her two larchwood gondolas, her balloons being fully charged with hydrogen.

The appearance of the vessel, however, made the ordinary layman think what a great side she raised to any wind which might arise. This, however, has been carefully provided for in her design. She has been constructed to withstand a wind pressure of a speed of 60 miles an hour, and the experts think no fear need be entertained, even if the wind travels at even a much greater velocity. She has the appearance of a big cigar, with her pointed stern and her bluff bow. All her resources for flying are hidden from view, but she looks as though designed for speedy flight, indeed, it is expected she will sail through the air at the rate of 45 miles an hour.

The airship is covered with a skin of metal-impregnated silk which is enclosed in a framework of duralumin, a new metal which has been patented by the Vickers Company, and which they manufacture at works specially equipped for the purpose at Birmingham. This metal is almost as light as aluminium and as strong as steel. It is not possible to ascertain whether the dirigible has mounted or will mount a gun or guns. This can only be ascertained after reports are available of her exhaustive trials, and probably on the success or otherwise of these trials will depend the nature of the design of airship No. 2, which is being talked about in Barrow as a successor of No. 1 now launched.

Not many particulars are available as to the airship's design, but authoritative information is to hand, that she [illegible] feet in length, with an external diameter of 48 ft. There are seventeen balloonettes in the envelope, and these have a capacity of 706,330 cubic feet of hydrogen. Her lifting capacity is 21 tons, and she is propelled by two eight-cylinder Wolseley-Siddeley motors The gas bags are of special Continental fabric, as used in the latest Zeppelin ships, and the outer cover, extending to about 46,000 square yards, has been rendered absolutely water-proof and gas-tight. The propellers rotate at 500 revolutions per minute, and the steering is effected horizontally by a triplane on each side under the blunt bow, and a biplane on each side abaft the horizontal fins, and vertically by two sets of triplane rudders, one above the stem and the other below. The two gondolas are connected by a passage way underneath the envelope, and this is utilised as berths for the crew. The dirigible has been specially designed to ride safely to a post on the water, even in the strongest of winds, and tests of her behaviour in this respect will be made during the preliminary trials which are now proceeding. She will also go through trimming and engine trials, and will elevate herself out of the water while still fastened to her mooring post. She has been designed either to float on the water or to fly in the air, and thus differs materially from the army airships which have been built. The idea is that this vessel shall be employed for several

days at a time on and over the sea, with sufficient capacity of returning to her base for repairs or fuel. She will thus be enabled to remain aloft longer than any other airship yet built, by means of her great supply of hydrogen, her greater supplies on board, and her power to negotiate gales. When alighting on land or sea she will have to depend wholly on her own crew, which consists of selected men who have had special training for the purpose. It is difficult to determine yet whether the vessel will have any practical usefulness in case of a naval war, but it was felt necessary by the Admiralty to make experiments with airships, seeing the attention which is being devoted to this feature of naval warfare by other Powers. Those in charge of the ship are, however, confident she will prove a great success from every point of view. It is not yet known when the vessel will take her experimental flight. It will probably be early in June before she is ready to leave Barrow, and it is, of course, hoped she will be able to fly to Portsmouth in time to be the *pièce de resistance* at the Coronation Review. She will be under the command of Lieutenant Neville F. Usborne, R.N., one of the navy's scientific officers, with Lieut. Talbot as second in command. Lieut. Usborne has been gaining experience with the French airships.

THE "PRINCESS ROYAL."

MESSRS. Vickers, Ltd., successfully launched from their shipyard at Barrow, on the 29th April, the latest battleship-cruiser *Princess Royal*, which was appropriately christened by H.R.H. the Princess Royal, of England. A distinguished party was present at the ceremony.

Laid down on the 2nd May, 1910, the *Princess Royal* has become water-borne just under the year, and would have become so earlier had not the launch been delayed owing to the recent dispute with the boiler-makers. She is a sister ship of the *Lion*, built at Devonport, and has an over-all length of 700 feet, beam 88½ feet, and on a draught of 27½ feet will displace 26,000 tons. The propelling machinery is of the Parsons turbine type, of 70,000 I.H.P., expected to give a speed of over 28 knots, and is under construction by Messrs. Vickers, Ltd. She will carry the huge 13·5" guns, and the total cost will be over £2,000,000.

Every effort is being made by Messrs. Vickers, Ltd., to have the vessel ready for delivery in May of next year, and to this end there are probably more men engaged on the vessel than ever employed before on a vessel. Between 1,500 and 2,000 men are engaged on the ship, and in addition there is quite an army of men busy with the various classes of work incidental to the completion of such a vessel. This activity is to prevail until she is completed, and will possibly be accelerated as she nears the time of trial.

PALMETTO PACKINGS.

THE Palmetto Twist Packing is made of a material unaffected by heat, having a high tensile strength and twisted in such a way that the size of the packing can be varied by unstranding it. Each strand is thoroughly saturated with graphite grease lubricant, so that it will not harden in service. It has been found, we understand, in actual practice to be particularly useful for small valve spindles, such as those of globe valves, blow-off cocks, injectors and similar apparatus and is claimed to be more economical and satisfactory than asbestos wick. This packing is put on the market by Messrs. Greene, Tweed & Co., of 15, Queen Anne's Chambers, Westminster, S.W., who also supply Palmetto (self-lubricating packing), either plaited round or square, for all steam and air pressures and especially adapted to high pressure and superheated steam.

A BOOK FOR SHIPMASTERS.—Amongst the many works of reference published for the instruction of master mariners there is probably none better known or more widely used than Dr. Benedict W. Ginsburg's "Hints on the Legal Duties of Shipmasters." Those for whose benefit the volume was completed will, therefore, be interested to learn that the third edition is now in the press. The various additions that have been made bring the book up to March, 1911, and it will thus be practically unrivalled as a legal guide to the shipmaster.

Messrs. W. H. Bailey & Co., Ltd., Albion Works, Salford, Manchester, were among the exhibitors at the Colliery Exhibition, Manchester. Their exhibit comprised pumping machinery, air compressors and a large variety of steam and water fittings. Specialities exhibited by the firm included Foster's patent reducing valve, Bailey's patent "key-ring" stop valves with renewable seats, Bailey's patent "silver star" force feed pump, lubricators, injectors and ejectors, and a large variety of pressure and other gauges, etc.

THE McNAB DIRECTION INDICATOR.

IN the records of the past there are plenty of instances of accidents occurring from the simple and easily made mistake of giving the engines a reverse direction of movement from that ordered. In such cases the officer in charge of the ship does not appreciate the error in carrying out his orders until he realizes the fact that what he expected to happen is not going to take place, but instead the very thing he does not want. In most cases it is then too late to remedy the mistake, and the result is an accident of a more or less serious character.

Attempts have been made in the past to reproduce the actual engine movements on the bridge from time to time, but owing to complication of mechanism and cost of installation, the results have not been satisfactory. We now have the pleasure of describing and illustrating a simple and inexpensive device which can be installed on the bridge, chart house or other position, and which will reproduce the identical movement of the engine either ahead or astern in unison with the engine itself, whether it is running fast or slow. Fig. 1 is a front view of the indicator which in this instance is combined with a revolution register; Fig. 2 is a view of the agitator and operating mechanism; and Fig. 3 is a sectional view of a ship showing the general arrangement of the apparatus between the engine room and the chart house and bridge.

The indicator proper consists of a frame holding two glass tubes, one for "ahead" and the other for "astern." In each tube a small piston is exposed which rises and falls in unison with the engine piston by means of a pulsating current of air produced by the engine itself. The direction of the engine determines the particular indicator to be operated. In addition to the visual indication, the device makes a slight sound in operation, so that the captain knows a reversal of the engine has taken place without looking at the indicator. The reciprocation of the indicator pistons is adapted to operate the revolution registers for "ahead" and "astern" motion.

The agitator shown in Fig. 2 is a simple plunger with special ring packing working in a barrel, and thus sets up a pulsating effect. It has neither a suction nor delivery valve. The device is made so as to be readily adapted to any engine; for instance, the connecting rod is provided with tapped ends, BB, so that any length of intermediate rod can be inserted. A similar arrangement is made with regard to the parts EE of the control rod. The connecting rod, B, of the agitator is connected to a reciprocating or oscillating part of the engine, such as the air pump lever, as shown in Fig. 3, so that at each piston stroke a pulsation simultaneously takes place. The barrel of the agitator is connected by a pipe C to a three-way cock, the other branches, G,F, of which are connected by pipes to the "ahead" and "astern" indicators respectively. The lever of this cock is connected by the rod E to the reversing gear of the engine, so that when the engine is going "ahead" the pulsating air is transmitted to the "ahead" indicator piston, and when going "astern" to the "astern" indicator piston; while in the "mid" or "stop" position of the valve gear the cock is closed and no air pulsation can be transmitted if any exists.

Fig. 1.

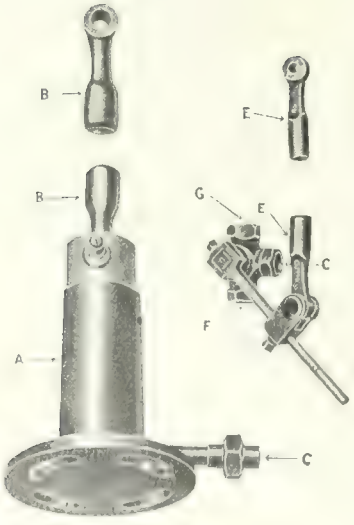


Fig. 2.

It will thus be seen that the engineer on receiving the signal to go "ahead" first throws his valve gear into the "ahead" position, and automatically puts the agitator into communication with the "ahead" indicator through the three-way cock. At each revolution of the engine an air pulsation is set up, which drives the indicator piston to the top of the tube and registers a revolution on the recorder. On the return stroke of the engine the air is drawn back and the piston falls ready for the next upward stroke.

The apparatus has been reduced to a very simple form, easily adaptable to any existing engine, and at a very moderate cost indeed. By its use a mistaken engine signal cannot take place without the captain or pilot having instant knowledge of the fact. Should an order be mistaken, the captain is in a position to correct the error before the ship has altered its momentum in the wrong direction. It may be said that one little mistake may cost a hundred times the cost of installing the system. To reduce the risk of damage in dry docking a large ship the expenditure of installation would be a very small premium. It is obvious that any number of indicators could be

installed in various parts of the ship as might be thought necessary.

The apparatus is being put on the market by The McNab (British) Indicator Company Ltd., of Queen Insurance Buildings, Castle Street, Liverpool, and various agents have been appointed in the principal shipping centres in this country.

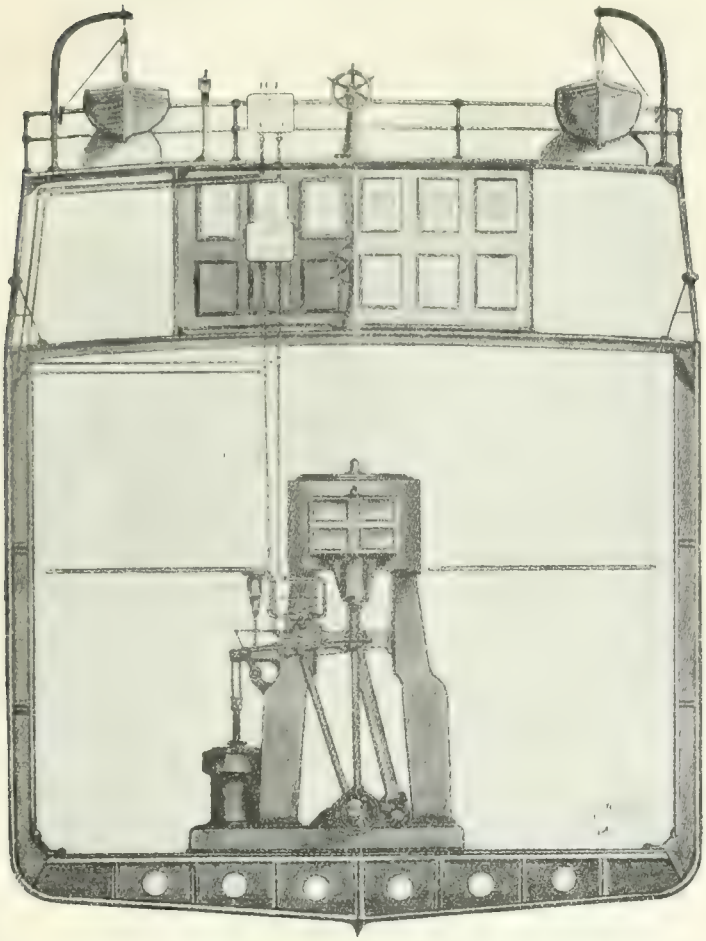


FIG. 3

MARINE OIL-ENGINE EXHIBITION.

MESSRS. Gray & Crowly, Ltd., Garrick House, 27, Southampton Street, Strand, who were the organizers of the successful exhibition held at Yarmouth a few months ago, are organizing an International Shipping and Oil-Engine Exhibition to be held at Newcastle in November this year. The prospectus before us points to an exhibition of considerable importance, and in view of the interest which is being shown in marine oil-engines, the exhibition will no doubt attract wide attention. It is to be noted that general support is being given to the Newcastle Exhibition by firms who were at Yarmouth, among whom are such leading makers as Messrs. Wm. Beardmore & Co., Messrs. A. Perman and Co., Messrs. Norris & Henty, Messrs. Hesse and Savory, Messrs. James Pollock, Sons & Co. and Messrs. Blackstone & Co., Ltd.

GAS-COAL AND OIL-ENGINED VESSELS.

MESSRS. Swan, Hunter & Wigham Richardson are to be congratulated on the success which has attended the coasting trials of the cargo trading barge *Toiler*, and on the announcement that with the confidence gained by the experience during the trials of this vessel, they are prepared to undertake the building and engining of others similarly fitted with oil engines. This is as it should be, and the firms who are devoting themselves to meet the coming requirements now multiplying in the market are wise in their generation. The annual reports and meetings of the two largest Scotch shale oil manufacturers—the Broxburn and the Oakbank—point to a greater output of mineral oil than the market demands, arising out of the increased production in certain oil fields of the world, aggravated by the exposure in court of the Standard Oil Trust in the termination of the trial and the verdict against the Trust. The by-products from the shale oil have been increasing in demand and the two companies referred to have suffered less financially owing to the sulphate of ammonia realizing a better price and a ready sale for its fertilizing properties. The question of N.H.P. for marine as for land motors is exercising the minds of engineers in discussing the relative performances of steam and gas engines so far as these are available for comparison, and also how the marine engineers will be affected in regard to the Board of Trade certificates in relation to the 99 N.H.P. There has ever been and there is still a good deal of elasticity in the application of the old rule for steam ships, which is based upon the squares of the diameters of the cylinders divided by a so-called constant, but as this latter has not been accepted by all builders there have been variations. The old Clyde rule $D^2 \div 30$, as steam pressures increased, gave wider divergence between the N.H.P. and the I.H.P., and the constant was gradually reduced until it has become about one-third, in some cases little more than one-fourth of its early standard in triple and quadruple engines. The present elasticity in the expression N.H.P. renders it quite inadequate as a basis for determining the true power value of a set of engines and in some cases when a Board of Trade examination for a certificate depends upon it, there is an undoubted hardship. The horse-power for road vehicles fitted with motors for registration purposes and taxation is $D^2 \div 2{\cdot}5$, and here we have the constant still further reduced to bring the registration power approximately nearer the actual. A controversy has been waged over this rule, the apparent allowance due to the constant for one horse power being 2·5, and if this be taken to represent square inches, it naturally and scientifically follows that D^2 should also represent square inches or the area of the cylinder diameters, which is less than the area of a square constructed on that diameter. If, on the other hand, the 2·5 is simply an arbitrary constant the rule can be defended by its framers —certainly the owner of the vehicle subject to taxation would maintain that the 2.5 in the divisor does represent square inches, and therefore the D^2 represents the square inches of area in the diameter of the cylinder. We agree with this view, as in the regulations it is stated thus " one-horse power for every 2·5 sq. in." Evidently there is a want of clear pronouncement both in respect to N.H.P. for marine engines and registered H.P. for land motors. The great scheme which has been proposed and discussed with a view to open up a waterway from the east to the west of Scotland to connect the Forth and the Clyde, has been gradually shaping itself into practical and practicable form. By a strange coincidence Grangemouth municipal leaders incline to keep the terminus of the large proposed canal away from that port, which is the terminus of the old Forth and Clyde Canal, on the waters of which the "*Charlotte Dundas*" floated; while those of Falkirk, three to four miles away, consider that the line of the present canal is the preferable path and would considerably increase the facilities for trade and add greatly to the prosperity of the locality. We incline to the Falkirk view, and are persuaded that the foundries and ironworks around Falkirk and Carron would benefit greatly by a ship canal, while Grangemouth itself would be materially advantaged. Apart from these convictions arises the natural shudder when we think of the beauty and romance of Loch Lomond being invaded and its nature sounds spoiled by those of the traffickers of the sea encroaching upon its domains.

It has ever been a source of wonder to us that our canals have not been used to a greater advantage. The Forth and Clyde Canal has been to some extent a great help to the trades and commerce of the lands through which it passes. The fears which were entertained—in the early years of steam, heralded by Symington's vessel—passed when the screw propeller came into being, and the number of steam lighters was increased, doing good service between east and west. The Monkland Canal has also historical interest in connection with the ancient question, "can iron swim?" for from its banks the answer was given by the floating of the first iron barge. With these two examples of pioneer work it seems a cause of regret that the canal system has not been more fully developed for the carriage of goods and produce to supplement the railway and road traffic throughout the country. The trials of the suction gas engined vessel, *Holzapfel I.* have so far proved satisfactory, including the quick action of reversing, and but for the mishap which occurred to the vessel in the Tyne, necessitating return to port for repairs to the stem, the results of a more extended trial might have been available, these however are merely postponed, and we hope to add our further congratulations to both owners and builders when the more extended runs of the vessel in active service take place. An accident recently happened, due to some petrol being spilt on the clothes of a workman while cleaning a motor, and a fellow-workman thereafter lighting a cigarette, a spark from which ignited the clothing and resulted in somewhat serious burns to both before the fire was extinguished. This incident shows that extreme caution should always be exercised in dealing with low test oils and spirit, and illustrates the adages as to familiarity and edged tools. We have heard of several cases, where even engineers of experience have had cause to regret holding flaming lamps over drums and tanks which contained compositions or oils which give off inflammable vapour, and it may be well to give this word of caution here. The specific gravity figure fixed for purposes of levying duty on naphtha spirit has given rise to a protest from some of the home manufacturers on the ground that it unduly presses them in their business, and adds to their cost of production for the market. The plea is a valid one, and if on investigation of other considerations, it may be allowed to rule, the authorities should amend the figure to suit.

The Dutch trader *Cornelius*, fitted with Diesel engines of 500 B.H.P., has made a voyage to the Thames and from the reports we gather that this vessel has proved to be economical and reliable as to the machinery, which is in charge of three men. The mission launch *George Wishart, the Martyr* fitted with 76 B.H.P. Beardmore oil engines, is now in regular service on the Thames and giving satisfaction; when running any distance at full power, the normal speed is 10 knots per hour. Another vessel of an interesting type which has appeared upon the Thames is fitted with double-acting gas engines, and the trials have indicated very favourable results, so much so that from the experimental craft there is a prospect of further developments commercially on a larger scale. The arrangements for the marine motor exhibition at Newcastle, referred to in a previous issue, are being carried into effect and promise to be of a highly interesting and valuable character. At the Glasgow Exhibition Messrs. Beardmore have on view a 95-B.H.P. crude oil engine and a 60-B.H.P. paraffin engine; both being in working operation, show their efficiency at work as well as their good points in appearance. The former engine is stated to run on a consumption of ·5 pint per B.H.P. per hour; it is directly reversible by compressed air, which is also used in starting. The new yacht for the Marquis of Graham is now well in hand and the engines of 180 B.H.P. being constructed by Messrs. Beardmore show good progress; the fitting of them in the yacht is being looked forward to in expectation of a highly satisfactory job. Motor auxiliaries are being tested and developed in order to meet the demand for such and the windlass and winch, with hydraulic transmission gear, recently tried, seem to be shaping well towards a prospect of commercial success.

THE BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD., inform us that the reports which recently appeared in some of the daily papers that the Company was about to cease the manufacture of gas engines is due to a misunderstanding and is entirely erroneous.

THE POLYRHOE CARBURETTOR FOR MARINE MOTORS.

THOSE who are users of petrol launches have had experience with the difficulties of obtaining efficient carburation under the varying conditions that obtain in such use. How annoying it is when the engine refuses to start up, particularly when time is of importance, such as in an emergency or a case of stress, and when once away variations in mixture are often difficult to make with precision so as to obtain a proper mixture at varying speeds. What one wants is a carburettor which can be adjusted temporarily so as to get an explosive mixture for starting up in even the coldest weather, and which can then be readjusted to a definite position to suit the actual conditions of working of a particular engine for all speeds.

Any internal combustion engine which depends for its charge on aspiration must necessarily have more or less air leak from the atmosphere to its interior, so that the proper mixture cannot be initially determined at the carburettor itself, irrespective of this disturbing factor which is a practically constant one in each individual engine, although different in amount comparing one engine with another.

One of the most, if not the most, scientifically designed carburettors used for motor vehicles is the "Polyrhoë," invented by Mr. Ionides, and manufactured by Messrs. Wadkin & Co., of Leicester, and so good are the results attained on the road, that it has been thought desirable to design carburettors of a similar type for use on motor boats having petrol engines. We illustrate this type in the adjoining diagrams, of which Fig. 1 is a perspective view of a carburettor for an engine of 400 h.p. Fig. 2 is a plan showing the adjustable air admission shutters. Fig. 3 is a transverse section. Fig. 4 is a longitudinal section, and Fig. 5 shows three detail views of the adjustable no-load device to correct the constant air leak of the engine by a predetermined definite quantity of petrol supply.

The carburettor body is generally of cylindrical formation, with the upper part cut away to form a throat, at each side of which are rows of jets formed by perforations arranged in superposed thin metal plates held down by a clamping plate and screws, and fed with petrol by vertical channels from the lower part of a float chamber. There are two float chambers, one on each side, each chamber being fitted with a float and needle valve in the usual way; at one end of the body is the throttle valve and flange for connection to the induction pipe, while at the other end is arranged a cylinder co-axial to and larger than the cylindrical body of the carburettor. Within the body and cylinder works a double piston of trunk form, having a differential area, and a spring is arranged tending to force the piston away from the cylinder cover towards the throttle.

Upon the piston of small diameter, are mounted two fence pieces which extend the piston body upwards to a substantial square formation level with the top of the throat, and covering at the sides the row of holes to the extent of the width of the fence. It will be seen that the spring tends to close the throat, while the suction of the engine passing through the trunk to the rear of the large piston tends to draw the fence back and open the throat, thus uncovering more

petrol jets. At the outer end of each fence is arranged a pivoted arm, made adjustable by means of two screws, so as to uncover a more or less number of jets at the side, although the throat is closed across the centre part of its end. The number so uncovered will be that which will allow sufficient petrol to pass to mix with the air leaks to form an explosive mixture when the throat is closed; this is clearly shown in Fig. 5.

On the upper part of the body, outside, are arranged two air flaps or shutters, which are made adjustable

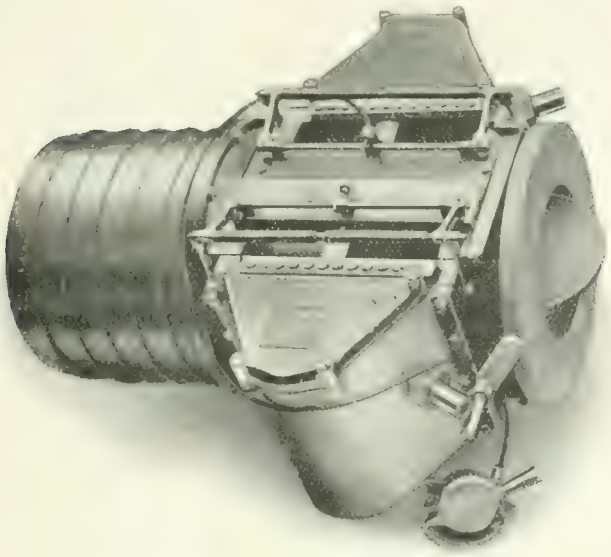


Fig. 1.

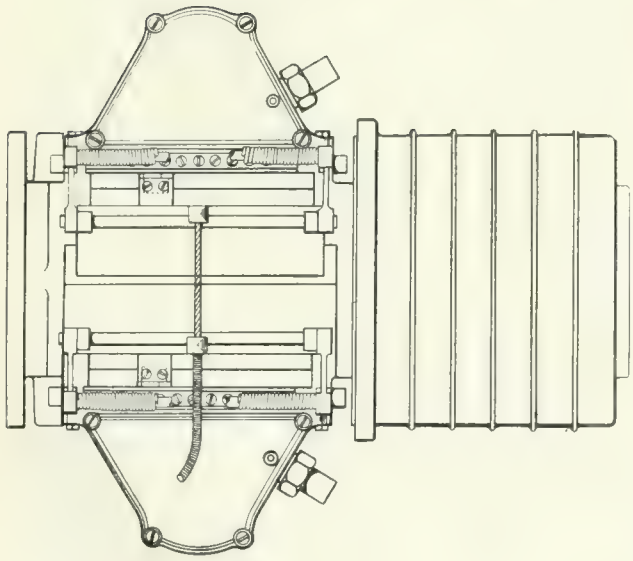


Fig. 2.

laterally by means of a Bowden wire, so that the width of the throat on each side can be varied at will to get the proper proportion of air for the petrol from the jets uncovered. These flaps are mounted on springed, pressed arms, arranged to keep the flaps in place as far as the suction is concerned, but should a back-fire take place they will lift and relieve the pressure at once through the open throat. In order to prevent the large piston tending to close the throat under these conditions, a check valve is mounted at the end of the trunk, which has a small bye-pass or leak for balancing the pressure on both sides normally, but which on a sudden rise of pressure is ineffective, so that the excess pressure forces the small piston back and cuts out the differential action of the two pistons.

The body of the carburettor is water-jacketed so as to maintain it at a high temperature; this is found to be an important matter if gas of uniform and constant character is to be produced.

Assuming that the no-load adjustment has been properly made, the air flaps have been regulated to

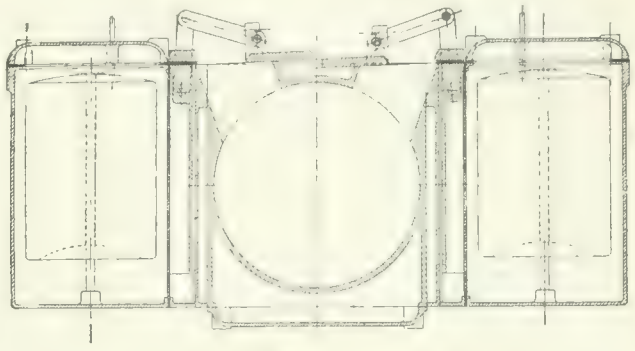


Fig. 3.

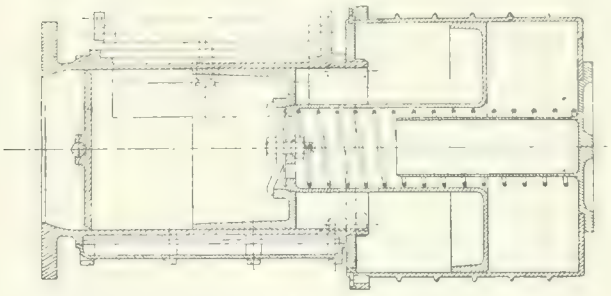


Fig. 4.

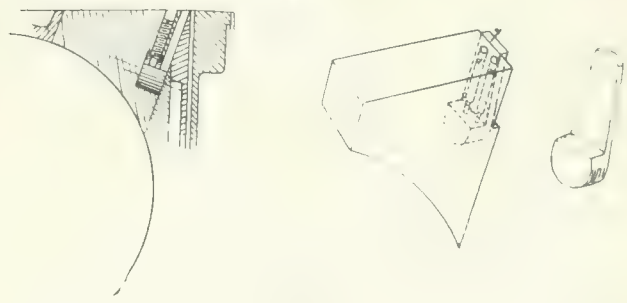


Fig. 5.

give the proper mixture of petrol and air, and the engine is running slowly on a closed throttle, it will be found that the throat will be nearly closed. Immediately the throttle is opened to speed up the engine, the suction on the differential piston is increased and it opens the throat against spring pressure. This opening does two things, firstly, it exposes a larger number of jets to the suction current passing through the throat, and secondly, it increases the area of the air passage directly in proportion to that of the petrol jets, so that the relationship between petrol and air remains constant, irrespective of the engine speed

This latter feature is the crowning feature in the operation of the device, as it gets over the difficulty experienced with the usual type of jet carburettor, *viz.*, that the petrol delivery by an inducing air current varies as the square of the velocity of such current, so that if you double the speed of the air current you get four times the petrol, or twice as much petrol as you require for proper and economic running.

We have had the opportunity of thoroughly testing one of these devices, and we find that it is quite easy to throttle the engine down to 10 % of its maximum and run it at any intermediate speed under the most efficient working conditions, and with no liability to stop. There is a further point, which is important, as to the ignition of an explosive mixture; if the mixture is of a constant character the ignition is the same for all speeds, while if the mixture varies, the timing of the ignition must be varied accordingly; for example, a weak mixture requires an earlier ignition than a rich mixture, consequently the ignition requires adjustment to suit the conditions of a variable mixture, which in itself is a tiresome duty and is often neglected, and inefficient and uneconomical running results.

The design of the apparatus has been thought out in a very thorough manner, and every detail appears to have been the result of careful experiment and calculation. It is not often that one comes across an automatic device which is so little liable to be deranged as this Polyrhoë carburettor.

THE CUNARD COMPANY AND THE FISHGUARD ROUTE.—The use of Fishguard as a port of call for the homeward trip of the vessels engaged in the Cunard Company's Boston service commenced on the 9th May. It fell to the lot of the *Franconia* on the completion of her first voyage to Boston, to initiate the movement.

THE TURIN EXHIBITION.—At the Turin Exhibition to be opened on the 9th and to continue to the 20th September, this year, several British firms are exhibiting, among whom may be mentioned The Fairfield Shipbuilding and Engineering Co., Ltd.; Messrs. Alley & MacLellan, Ltd., The Burma Oil Co., Ltd., Messrs. D. & W. Henderson & Co., Ltd., Messrs. Laidlow & Co., Ltd., and others. Under the auspices of the Italian Electro Technical Association and committee an International Congress of the Applications of Electricity will be held at the same time. The president of the committee and organization invites interested parties to send papers in to be read before the Congress. It is intended that the papers read shall form the basis of interesting discussions.

COLD STORAGE AND ICE ASSOCIATION.—The annual dinner of this Society was held in the Waldorf Hotel, Aldwych, on Tuesday, May 2nd, presided over by the President, Chas. E. Brightman, Esq. Among those present were Sir Montague Nelson, Sir Geo. H. Reed, Sir Wm. Hall Jones, Sir Thos. Borthwick, Mr. L. Sterne, and Mr. James Adamson, honorary secretary of the Institute of Marine Engineers. Sir Thos. Borthwick gave the toast of "The Industry of the Association" in proposing a brief outline of the progress which had been made in the carriage of produce and the success which attended its development. The Association was doing good work, and the justification of its formation was manifest from the fact that the papers and discussions had been productive of views being expressed for the general information of all concerned. The President, in responding, gave figures to show the enormous strides which had been made since the first cargo of frozen produce was brought to Britain. The pioneer experimenters deserved credit for their labour and enterprise, as such had been productive of a vast industry which is still growing and increasing. The Association was formed mainly through the efforts of Mr. Leonard, who served so well as hon. secretary and whom they were pleased to see with them on the occasion of their annual dinner, [illegible] other work had compelled him to retire from the office.

WHITE STAR LINERS "OLYMPIC" AND "TITANIC."*

NO better instance of the spirit of enterprise can be produced than the building of the White Star Liner *Olympic* and her sister ship *Titanic,* constructed as they have been side by side at Messrs. Harland & Wolff's Ship Yard, Belfast. The spectacle of these two enormous vessels on adjoining slips, representing over 100,000 tons displacement, was altogether unprecedented, and naturally the public interest taken in the vessels on both sides of the Atlantic has been very keen. A number of illustrations have appeared in *The Marine Engineer and Naval Architect* from time to time showing the different stages of construction of the *Olympic* and *Titanic,* and also illustrations of the machinery to which the reader is referred.

For convenience the following description of the vessels has been arranged in three parts—the first dealing principally with the hull, the second with the decorations, and Part III. with the machinery.

1. The construction and general features of the ship.

Leading Dimensions :—

Length over all	882ft. 9in.
Length between perpendiculars	850ft. 0in.
Breadth, extreme	92ft. 6in.
Depth, moulded, keel to top of beam, bridge deck	73ft. 6in.
Total height from keel to navigating bridge	104ft. 0in.
Gross tonnage	about 45,000 tons.
Load draft	34ft. 6in.
Displacement	about 60,000 tons.
Indicated horse-power of reciprocating engines	30,000
Shaft horse-power of turbine engine	16,000
Speed	21 knots.

The work of both ships has been carried on in a most expeditious manner. The first keel-plate of the *Olympic* was laid on December 16, 1908, and by March 10 following the double bottom was all bolted up, and the work of riveting it by hydraulic power well advanced. The whole of the side framing, which was commenced from the stern, was finished by November 20, 1909, and the plating was completed and almost entirely riveted by April 15, 1910. The vessel, as is well known, was launched 20th October, 1910, and practically only seven months have been taken up in the subsequent work of completion. When the dimensions of the ship are remembered, this performance will be recognised as highly creditable to all concerned. The centre keelson is 5 ft. 3 in. deep, the flat keel-plate $1\frac{1}{2}$ in. thick, and the keel bar 3 in. thick. There are four intercostal girders on each side between the centre keelson and the margin plate, but under the machinery compartments there are additional girders. Between the margin plate and the turn of the bilge are wing ballast tanks. The double bottom was riveted by hydraulic power, the machines being suspended from overhead travellers. This double bottom is utilised for carrying water ballast, the floor plates between the intercostal girders having lightening holes, except at intervals, where they are without holes, to form separate ballast-tanks.

In three and a half months' progress the frames extended to the bridge-deck—the eighth level from the inner bottom—a height from the bilge of 66 feet, and are spaced three feet apart, except at the bow and stern, where they are respectively 24 in. and 27 in. apart. They are of channel section, 10 in. deep amidships, and of angle and reverse bars at the ends. At frequent intervals there are heavy-web frames. Increased strength is ensured at the machinery spaces by the web-frames being placed at closer intervals.

* By the time this number of "THE MARINE ENGINEER AND NAVAL ARCHITECT" is in the hands of our readers, and according to the arrangements fixed at the time of writing, the *Titanic* will have left the ways and become waterborne. The *Olympic* will have arrived in the Mersey on June 1st, where an opportunity will be given to visitors to inspect her, a small charge being made, the proceeds going to local charities. The *Olympic* is due at Southampton on June 3rd, and arrangements are being prepared to give the vessel a reception worthy of the occasion. Her maiden voyage is to commence on the 14th of June, under the command of Captain Smith. In our July issue we shall include pictures of the launch of the *Titanic* and illustrations showing the splendid passenger accommodation of the *Olympic*. The exhaustive description of both vessels, of which we publish a part in this issue, will be concluded.

Specially heavy bracket plates connect the frames with the wing brackets. As the framing proceeded the transverse beams were fitted in place on each deck-level. These beams are made of channels 10 in. deep, up to the lower deck, and of smaller section above this: all are placed, of course, to suit the spacing of the frames, to which they are connected by efficient brackets. There are four longitudinal girders in the width of the hull extending for the whole length of the ship. These are built up of plates with deep angles at top and bottom. Owing to the width of the holds required for the machinery spaces, these girders could not be made continuous; but at the engine and turbine compartments special girders were put in with a collective sectional area equal to that of the four girders in other parts of the ship. Stanchions are erected at frequent intervals under the girders; those under the middle deck—the third level above the inner bottom—are of built-up steel columns, and above this they are of solid steel of less diameter. The latter section was adopted, as they could be placed at more frequent intervals. On the lines of these girders and columns the deck-plate has been increased in thickness. This general description of the structure indicates the great strength of the hull, the aim being to ensure the maximum of stiffness in a heavy seaway. To the same end the deck plating, which is of steel throughout, was specially strengthened by having thicker plating on the two topmost levels of the moulded structure—on the shelter and bridge-decks.

The shell-plating also is exceptionally heavy. It is for the most part of plates six feet wide and of about 30 feet in length. The width tapers towards the ends, as shown in the bow and stern views of the completed ship. The laps are treble riveted, and the sheer-strakes in the way of the shelter and boat-decks have been hydraulically riveted. This also applies to the turn of the bilge, where bilge-keels, 25 in. deep, are fitted for 295 feet of the length of the vessel amidships.

There are fifteen transverse water-tight bulkheads, extending from the double bottom to the upper deck, at the forward end of the ship, and to the saloon deck at the after end—in both instances far above the load water line. The room in which the reciprocating engines are placed is the largest of the water-tight compartments, being about 69 feet long; while the turbine room is 57 feet long. The boiler rooms are generally 57 feet long, with the exception of that nearest the reciprocating engine compartment. The holds are 50 feet long. Any two compartments may be flooded without in any way involving the safety of the ship.

The two decks forming the superstructure of the ship and the navigating bridge are built to ensure a high degree of rigidity. At the sides they are supported on built-up frames, in line with the hull-frames, but at wider intervals. . The deck-houses are specially stiffened by channel-section steel fitted in the framework, and where, as on the boat-deck, the public rooms pierce the deck, heavy brackets are introduced to increase strength against racking stresses when the ship is steaming through a heavy sea-way.

Expansion joints are made in the superstructure above the bridge-deck at convenient points in the length—one forward and one aft—the whole structure being completely severed and the joints suitably covered.

Stern-Frame and Boss-Arms.—The stern-frame of such a vessel is of special interest. It was made by the Darlington Forge Company, and some idea of its size may be formed by the fact that the total weight of the casting was about 190 tons, the stern frame being 70 tons, the side propeller brackets 73¼ tons, and the forward boss-arms 45 tons. The centre propeller, driven by the turbine, works in the usual stern-frame aperture, while the wing propellers are supported in brackets. The chief dimensions of the stern castings are as follows:—

Stern frame: Height, 67 ft. 0½ in.; length of keel-post, 37 ft. 4 in.; section of gudgeon-post, 21 in. by 13 in. After brackets, centres of shafts, 38 ft. 10¾ in.; diameter of bosses, 5 ft. 2¼ in. Forward brackets, centres of shafts, 38 ft. 5⅛ in.; diameter of bosses, 6 ft. 2in.

The stern-frame is of Siemens-Martins mild cast steel, of hollow or dish section, in two pieces, with large scarphs, one on the forward post and one on the after post, connected with best Lowmoor iron rivets, 2 in. in diameter, the total weight of rivets being over a ton. The care exercised in fitting these to ensure a strong connection is suggested by the fact that they were all turned and fitted and specially closed with rams. There are in all 59 rivets in the forward and 53 rivets in the after scarphs. In the stern-frame there is, of course, the boss for the shaft driven by the turbine, the lower portion of this part of the stern-frame having a large palm cast on its extreme forward end, to give a solid connection to the after boss-arms and main structure of the vessel.

The after boss-arms are also of mild cast-steel, of hollow section. Particular attention was paid to the angle of these boss-arms, to ensure the easiest flow of stream-lines to the turbine propeller, in order that it might rotate in solid water. The boss-arms are in two pieces, connected at the centre line of the vessel by strong, deep flanges, to form a continuous web across the ship. This web, again, is riveted to a 2 in. steel plate of special quality forming a bulkhead across the ship. Forward of this boss there is another set of arms of the girder pattern, the port and starboard pieces being connected again in the centre of the ship; and, in addition, there are other heavy web-plates down the ship's side connecting same to the ship's floor.

The Rudder.—The rudder, constructed by the Darlington Forge Co., Ltd., is of the usual elliptical type, of solid cast steel, built in five sections, coupled together with bolts varying from 3½ in. to 2 in. in diameter. The top section of the rudder is of forged steel from a special ingot of the same quality as naval gun-jackets. The rudder pintles are arranged each to take its own proportion of the rudder weight, having hard-steel tops or cups inside the stern-post gudgeons. The pintles are 11 in. in diameter, of hard steel, and are fitted with a taper in the rudder gudgeons so that they can be tightened up in the gudgeon when required. These are provided on top with a solid covered nut having set-pins to prevent the pintles turning. A special feature is that the bottom of the rudder is so arranged that screw jacks can be employed for lifting it in dry dock. This will greatly facilitate this work. The total weight of the rudder is 101¼ tons, while its length over all is 78 ft. 8 in., and its width 15 ft. 3 in. The diameter of the rudder-stock is 23½ in.

The Stem.—The stem is of the usual rectangular section, of rolled steel with a cast-steel forefoot of hollow section connecting stem to keel plate and keel bar. A special feature is that there is provided at the top a hawse-pipe. Through this a steel wire hawser can be passed for use in connection with a central bower anchor, in addition to the port and starboard anchors. The centre bower anchor is of 15½ tons weight, and the side anchors are each 8 tons in weight, the cables used, 330 fathoms long, being of 3 3-8ths in. diameter. The centre bower anchor has a wire rope instead of a cable, the length of the rope being 175 fathoms, the breaking strain being 290 tons. The innovation of a central hawse-pipe had the great advantage that it reduced the necessary weight of the side anchors to reasonable limits.

The Arrangement of the Decks.—There are ten decks in the ship, named from the bottom upwards:—Lower orlop, orlop, lower, middle, upper, saloon, shelter, bridge, promenade, and boat. The passenger decks—promenade, bridge, shelter, saloon, upper, middle, and lower, are named alphabetically A, B, C, D, E, F, G. Two of the decks are above the moulded structure of the ship. The lower orlop, orlop, and lower decks do not extend for the complete lengh of the structure, being interrupted for the machinery accommodation. The bridge deck extends for a length of 550 feet amidships, the forecastle and poop on the same level being respectively 128 feet and 106 feet long. The promenade and boat decks are also over 500 feet long. The first-class passengers are accommodated on the five levels from the upper to the promenade decks. The second-class passengers have their accommodation on the middle, upper and saloon decks, and the third-class passengers on the lower deck, forward and aft, and on the middle, upper and saloon decks aft.

(To be continued.)

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

The Progress of the Turbine Engine.

THE turbine principle appears to have had a set-back from the announcement that the Great Central Railway is about to have the turbine engines removed from its two steamships *Marylebone* and *Immingham* and have them replaced by machinery of the old reciprocating type. The steamers in question were built—one at Birkenhead by Messrs. Cammell, Laird & Co., and the other at Newcastle by Messrs. Swan & Hunter and Wigham Richardson & Co., in the year 1906, the turbines for the latter coming from the shops of the Wallsend Slipway Co. The vessels were intended for the Grimsby and Rotterdam passenger and cargo service of their owners, and they have been on the route for about five years and attained some popularity with the travelling public. The announcement that they are to be converted to twin from triple screws by Messrs. Earle's, of Hull, came possibly as a surprise to some travellers. But the fact of the matter is that the ships were never really suitable for turbine propulsion as originally designed. Their legend speed is but eighteen knots, and no doubt on service they fall somewhat short of that standard. Now it is well known that economy cannot be attained in the direct working of turbine engines at a low speed, and for that reason the ships must have been uneconomical to run. That a change is to be made need not excite surprise. But in view of the experiments with the cargo steamer *Vespesian* and of the fact that the principle of geared turbine engines has been adopted by the London and South Western Railway for their new steamships for the Southampton and Havre route, one might have thought that it would have been more advisable to alter the machinery from direct to gearing drive. Possibly, however, it was found that such an alteration as this would be even more costly than the provision of new reciprocating engines. Against this apparent set-back, however, there are two real triumphs to be recorded for Mr. Parsons' invention. First the London and North Western Railway—hitherto a firm adherent to the twin screw principle for its Holyhead fleet—is seeking tenders for two new vessels to be fitted with turbines. Possibly the directors have seen enough of the working of the new Fleetwood steamships (which they own jointly with the Lancashire and Yorkshire Railway) to make them feel confident that for their special trade to Dublin the turbine has advantages over the older type of ship. Then we have the announcement that the Hamburg-American Company have decided that the new 50,000 ton vessel which they have under construction at the Vulcan Yard at Stettin for their New York express trade is to be fitted with turbines. The Hamburg Company made certain experiments with a small local passenger steamer, the *Kaiser,* some time ago. But they did not seem encouraged to adopt the principle for their larger vessels, and the fact that the as yet unnamed German monster is like the Cunarder *Acquitainia,* to be driven by turbines, is the highest testimonial to the value of Mr. Parsons' invention which it has yet received from the Mercantile Marine of Germany.

The Elder-Dempster Company.

Some interest attaches to the first report of the organisation which was brought into existence to carry and develop the various properties which were left by the late Sir Alfred Jones. It is a highly satisfactory document. A dividend at the rate of eight per cent. seems to have been earned and paid on the ordinary and management shares, and that on quite conservative lines. For whereas the articles of association provide that £15,000 shall be carried each year to reserve, the directors have thought it prudent to increase the sum taken for the period under review to £25,000. They have further written off the whole of the preliminary expenses, which amount to upwards of £56,000. Beyond this they have subscribed a sum of £10,000 towards the extension of the British Cotton Growing Association's objects—a development which was very dear to Sir Alfred's heart and one which will probably in years to come be highly beneficial to many British interests—and not the least amongst them to the ship-owning fraternity. Finally, they have written down the value of their £10 shares in the Imperial Direct West India Mail Service Company, Ltd., to one-tenth of their nominal value. This they have done in view of the fact that the forty-thousand-a-year banana subsidy has been withdrawn by the Government, and that the steamers of the line are thus at the moment without occupation. Whether these steamers will ever again be employed in the direct service to Jamaica remains to be seen. But assuredly whatever happens the assets of the Direct Service are worth one-tenth of their face value, if disposed of by auction without any goodwill.

An interesting point was mentioned at the meeting of the Elder Dempster Company, and one that throws a strong sidelight on the methods of the new management. Amongst the assets taken over were two South Wales collieries which had been a continual drain on Sir Alfred Jones during the ten years that had passed since he acquired them. They had been bought, not so much for the cash return that might be hoped of them, as for the reason that the possession of such a source of supply rendered a shipowner to some extent independent. But a drain could not be allowed to continue under the new management. The collieries were at once shut down pending re-organisation. Such a re-organisation as took place must have been of a somewhat drastic character, for the experience of the short time that has elapsed since their re-opening has shown that the action that has been taken has turned the loss into a profit.

The Brocklebank Line.

This old established Liverpool Company has recently lost its head through the death of the late Sir Thomas Brocklebank. Of the two members of the family who remained on the Board one—Mr. Ralph Brocklebank subsequently retired, leaving only Sir Aubrey Brocklebank, the successor to the baronetcy. The management has, however, been strengthened by the accession of three members of another old Liverpool shipping family to the Board—these are Sir Percy and Messrs. F. and D. Bates. It is said that there will be no amalgamation of the two lines. But such a close understanding between the managements of the two companies must have certain results, and tend to eventual co-operation. It may therefore be interesting to record the composition of the two fleets.

Messrs. T. & J. Brocklebank own :—

		Built		Place of Building.	Builders.
1.	*Cardiganshire,* ex *Ameer*	1889	Single-screw	Belfast	Harland & Wolff
2.	*Carnarvonshire,* ex *Gackwar*	1890	Single screw	Belfast	Harland & Wolff
3.	*Breconshire,* ex *Pindari*	1891	Twin-screw	Belfast	Harland & Wolff
4.	*Glamorganshire,* ex *Marwarri*	1900	Single-screw	Dundee	Gourlay Bros.
5.	*Montgomeryshire,* ex *Bengali*	1901	Single-screw	Dundee	Gourlay Bros.
6.	*Mahronda*	1905	Single screw	Belfast	Harland & Wolff
7.	*Malakand*	1905	Single screw	Belfast	Harland & Wolff
8.	*Manipur*	1906	Single-screw	Belfast	Harland & Wolff
9.	*Matheran*	1906	Single-screw	Belfast	Harland & Wolff

The following vessels were managed by Messrs. E. Bates & Sons when Lloyd's Register published its last list :—

1.	*Imaun*.....	1890	Single-screw	Belfast	Harland & Wolff
2.	*Iran*	1896	Twin screw	Belfast	Harland & Wolff
3.	*Istrar*.....	1896	Single-screw	Belfast	Harland & Wolff
4.	*Imani*.....	1897	Single-screw	Belfast	Harland & Wolff

But the *Imani* has since been sold to foreigners. It will be seen that the direct interest of Messrs. E. Bates & Sons in shipping is now relatively small, and that the class of ship owned by the two companies is very similar.

Disasters.

Under the name of *Asia* a well-known passenger ship of former days has disappeared, for under this name is disguised the old *Doric* of the White Star Line, which was built in 1883 by Messrs. Harland & Wolff for charter in the New Zealand trade. After many years service the vessel was transferred to the Trans-Pacific service, making a record for a non-stop voyage as she went out to her new station. A few years ago the White Star Line disposed of her to another British Company, who, however, retained her in commission on the Pacific, and chartered her to an American Company—the Pacific Mail Co. At the end of April she was lost near Shanghai, striking on Finger Rock in fog. There was fortunately no loss of life—though

one of the engineroom staff was at first reported as missing. The mails also were saved. But as soon as the ship was abandoned she was stripped by Chinese pirates, who indeed were at one time more threatening than the perils of the sea. They appear to have reaped a rich harvest, as their loot included £10,000 worth of silk. There will not improbably be diplomatic trouble over this incident, as it is reported that the officers of certain Chinese warships refused to attempt the recovery of the stolen property on the ground that such action was "none of their business."

Another important casualty was that of the twin screw Ward liner *Merida,* sunk by collision with the *Admiral Farragut,* also an American passenger steamer off Cape Charles. The injuries of both vessels were severe, but fortunately the chief damage to the *Admiral Farragut* was forward the collision bulkhead. In this case wireless telegraphy again proved its value, as when the two vessels parted in the fog the *Merida* was able to call up assistance, the battleship *Iowa* and the Old Dominion Liner *Hamilton* coming to the rescue, and saving all hands. In addition to the crew the *Merida* seems to have had on board some two hundred passengers. A considerable quantity of silver bullion is reported to have gone down with the ship, there having been no time to save anything but life. The *Merida* was a 6,000 ton ship built at Philadelphia in 1906 by Messrs. Cramps.

Wireless at the Cape.

The Cape Government wireless telegraph station at Slangkop is now open, and on the 10th May it communicated with three vessels of the Union Castle Line, *viz.*: the mail steamers *Balmoral Castle* and *Edinburgh Castle* and the intermediate steamer *Dunluce Castle.* The station got in touch with the last-named vessel when she was at a distance of no less than 1,500 miles. It will be seen that with its usual foresight the Union Castle Company has provided its ships with installations before the authorities have provided the necessary land stations. But the South African voyage—being as it were coasting on an ocean scale—is an ideal one for this mode of communication, and it will not be long before the Union Castle Liners which can now speak to one another and to vessels of other lines fitted with installations, will be within range of one or other land station during the whole of their 6,000 mile journey.

Whilst speaking of the Union Castle Line I may mention that the two Clyde built sisters to the twin screw *Galway Castle* (recently launched by Messrs. Harland & Wolff) will be put on the water within the next few days, the *Gloucester Castle* by the Fairfield Shipbuilding Co., and the *Guildford Castle* by Messrs. Barclay, Curle & Co.

New Methods of Propulsion.

The Diesel engined cargo vessel *Toiler* seems to have achieved success on her maiden voyage from the Tyne to Calais. She shifted a deadweight of just under 2,700 tons at a speed of 5.9 knots, starting in heavy weather. The consumption was 6½ tons of oil for the round voyage, or about 1¾ tons for each day's steaming.

It seems possible that, in spite of repeated attempts, always followed by failure since the days of Mr. William Lindsay, there may really be a future for the auxiliary sailing ship now that the oil engine has become eminently practicable for marine purposes. At all events, the Liverpool firm of Job Bros., who have a considerable trade between St. John's, Newfoundland and Brazilian ports with a fleet of sailing vessels, believe that it is worth while to attempt to shorten the maximum length of voyage —which, on occasion, thanks to the prevalence of calms— runs to 40 or even 50 days. It is held that a vessel fitted with an engine capable of driving her at seven knots will be able to reckon on completing the voyage in ten days' time. Accordingly the firm have arranged that a new sailing ship now under construction for them at a Rotterdam shipbuilding yard, shall at completion be taken to Southampton and fitted there with a Diesel engine by Messrs. Thornycroft. It is believed that the vessel will be ready for work within about four months.

The Pacific Steam Navigation Company.

by its recent developments has enabled a traveller to perform a very remarkable feat. He proceeded from Liverpool to Buenos Ayres by the Company's mail steamer *Oropesa.* There he took the railway to cross the continent to Valparaiso, and there caught the P.S.N. steamer *Ortega* just about to depart for Northern Ports. By this means he reached Iquique in 29 days 20 hours from the time he left Liverpool.

The Canadian Service.

The month of May has seen the new Cunard service to Canada opened by the sailing of the *Albania.* I notice that the master, Capt. G. F. Jeffries, is an old employé of the Cunard Company, whilst the chief engineer's name—Mr. George Bain—also savours of the traditions of the great Liverpool company. A considerable proportion of the officers both on deck and in the engine-room, however, had previously served in Cairn Line vessels.

The *Teutonic,* hitherto a mail steamer between Southampton and New York, made her first sailing from Liverpool in the second-class service of the White Star-Dominion Line on the 13th May. Thus she returns to her old port after an absence of some years.

It has been officially announced by Sir Wilfred Laurier in the Dominion Parliament that the present arrangements as to the conveyance of the mails between their Company and Canada are about to be terminated. A new system whereby payment is based on the weight carried will be inaugurated. But if the Canadian Government carries out its suggestion that a service of twenty-one knot vessels be arranged, the payment of £100,000 a year for mail carriage—on whatever basis it be distributed—will hardly be likely to find sufficient compensation for the shipowner.

THE ROYAL INSURANCE CO., LTD., of Liverpool, have issued the 8th Edition of their "Record of Sports." All sections of sport are dealt with, and the volume is supposed to form the most accurate and up-to-date record in existence

MESSRS. E. G. APPLEBY & CO. inform us that they have met with considerable success in the sale of the Kerpely Gas Producer, and they have an order for seventeen producers of the largest size.

A NEW POWERFUL MOTOR COASTING VESSEL is being designed and constructed by Messrs. James Pollock, Sons and Co., Ltd., of London and Liverpool, and is being fitted with a 120 B.H.P. Bolinder's direct reversible crude oil engine, capable of working up to 150 B.H.P. or 185 I.H.P. The dimensions of this useful vessel are :—Length overall, 92 ft. 8 in. by 19 ft. by 7 ft. 8 in., with a deadweight capacity of 170 tons.

THE CUNARD COMPANY have issued a booklet of their London and Southampton—Canadian Service by the S.s.'s *Albania, Arisonia,* and *Ascania.* The *Albania* opened the service on May 2nd, and the *Ascania,* formerly the *Gerona,* sailed on her maiden voyage on the 23rd May. A number of guests were invited to inspect the *Ascania* on the 22nd May. These vessels carry second cabin and third-class passengers only.

THE CUNARD LINER "IVERNIA."—At the time of going to press we learn that the Cunard liner *Ivernia,* homeward bound from Boston to Liverpool, struck the Daunt Rock when nearing Queenstown. The vessel was beached and her 728 passengers safely landed, some of their effects having to be left behind. Divers have discovered a large hole on the starboard side, through which a great volume of water has rushed into the vessel. Temporary repairs will no doubt have been effected by the time this issue is before our readers, and the vessel cleared of water. The *Ivernia* is 582 ft. in length, 64 ft. 9 in. breadth, 37 ft. 8 in. depth, and was built in 1900.

THE INSTITUTION OF CIVIL ENGINEERS.—The Council of The Institution of Civil Engineers have made the following awards for Papers read and discussed during the Session 1910-1911 :—Telford Gold Medals to Mr. W. J. Wilgus (New York) and Mr. J. Walker Smith (Edinburgh); a George Stephenson Gold Medal to Mr. Philip Dawson (London); Telford Premiums to Messrs. G. W. Humphreys (London), H. K. G. Bamber (Greenhithe), A. E. Carey (London), William Dawson (Crewe) and C. S. R. Palmer (London); and the Trevithick Premium to Mr. A. T. Blackall (Reading). The awards for Papers published in the Proceedings without discussion and for Students' Papers will be announced later.

SCOTTISH EXHIBITION OF NATIONAL ART AND INDUSTRY.

Marine Exhibits.

II

IN an exhibition where history and evolutionary development really form the keynote it is but natural to find the shipbuilding firms on the Clyde, whose history extends back to the earliest stages in steamship building, and to even a prior date, putting themselves in evidence and taking pains to illustrate the notable facts and achievements in their annals. From this point of view it is fitting to find amongst the exhibitors making attractive displays such firms as Messrs. Wm. Denny & Bros. (whose highly interesting stand was dealt with in our article last month); Messrs. Barclay, Curle & Co., Whiteinch; Scotts Shipbuilding & Engineering Co., Greenock; and Messrs. Wm. Simons & Co., Ltd., Renfrew. Shipbuilding and engineering concerns, however, whose pride of place is not so much one of long establishment as of distinguished achievement in the domain of up-to-dateness, are also represented quite as notably; and from this point of view attention and admiration will be arrested by the exhibits of Messrs. John Brown & Co., Ltd., Clydebank; Yarrow & Co., Scotstoun; Beardmore & Co., Dalmuir; Fairfield Shipbuilding & Engineering Co., Govan, etc.

MESSRS. BARCLAY, CURLE & CO., LTD., Shipbuilders, Whiteinch, and Stobcross Engine Works, Glasgow, display an attractive collection of models representative of the varied classes of merchant ships which have emanated from their stocks. Here again regard has been paid in the selection to the evolutionary aspect of the work achieved by the firm during its long history as well as to giving due prominence to up-to-date productions. Paintings of the company's shipyard and building slips at Stobcross as these existed in 1845 and in 1865 are shown. One of their notable early productions is represented by a model of the wooden ship *City of Glasgow,* built in 1848, the pioneer vessel of the City Line. Others are a model of the paddle steamer *Athole,* built for passenger service in 1866, and one of the four-masted, steel barque *Nord,* built in 1890 for A. D. Bordes & Son, Bordeaux, while a painting is also shown of the first four-masted ship to be built, the *County of Peebles,* built by the firm in 1875. Models of steamships contributed to the P. & O. Company's fleet are those of the *Sicilia,* 1901, and the *Morea,* 1908; to the fleet of the Union Castle Mail Steamship Co., the *Braemar Castle,* 1898, and the *Guildford Castle,* at present on the stocks; to the fleet of the B.I.S.N. Co., the *Edavana* and the *Elephanta,* built this year. An up-to-date interest attaches to the model of the 7,000 ton twin screw motor vessel, driven by two sets of Diesel Oil Engines, at present being made in the firm's engine works at Stobcross.

MESSRS. WM. SIMONS & CO., LTD., Renfrew, are worthily represented by an attractive collection of models and photographs of their modern productions in the way of dredgers and dredging plant of all kinds, and of models of notable ships built for mercantile as well as for naval purposes. Founded in 1810, first at Greenock, the business was for a time transferred to the St. Lawrence, near Montreal. The first three vessels built in Canada were ships of from 315 tons to 454 tons, and were followed by four others for His Majesty's Service. Two of these were gunboats, built in 1813. The third was the *Linnet,* a brig-of-war of 300 tons, launched on May 2, 1814, and carrying 16 guns. After a desperate action, on Sept. 11, 1814, she was captured by the Americans. The last of the four, the frigate *Confiance,* was launched on August 16, 1814. One of the most interesting exhibits on the stand of Messrs. Simons is a model of this vessel. The model, which appears to have been made about the time the ship was built, and which is in a good state of preservation, has been renovated in accordance with the original designs of the vessel, and is a fine representation of a frigate of that period, full rigged and showing all her 37 guns. The *Confiance,* which was a vessel of 800 tons, had a complement of 400 men. The model is not carved out of one piece of wood, but is built of planks and timbers like a real ship, and is fully coppered below the water line. Something of historical importance also attaches to the model of the *William Connal* built in 1851, the first vessel to be fitted with wire rigging. Then there is a series of half models of cutter yachts for which, in the fifties of last century, the firm was quite noted as well as for river steamers. It is, however, in the greatly more utilitarian domain of dredger building that the firm has for many years won renown, and a representative collection of full models and photographs of vessels of this special class produced in recent years will engage the attention of visitors, as will also the similarly varied display of such productions at the adjoining stand of MESSRS. LOBNITZ & CO., LTD., Renfrew.

THE FAIRFIELD SHIPBUILDING & ENGINEERING CO., LTD., Govan, show a number of beautiful models of modern vessels including the Canadian Pacific liners *Empress of Britain* and *Empress of Ireland;* H.M.S. *Indomitable;* H.M.S. *Glasgow;* the Royal Indian Marine troopship *Hardinge;* the Union Castle liner *Durham Castle;* and the Czar of Russia's curiously shaped yacht *Livadia.* On the adjoining stand Messrs. Wm. Beardmore & Co., Ltd., Dalmuir, show splendid full models of naval productions in the battleship *Agamemnon,* and the cruisers *Carnarvon* and *Gloucester,* and have at the same stand working examples of their patent marine oil engine.

SCOTT'S SHIPBUILDING & ENGINEERING CO., LTD., Greenock, content themselves with a small space, of which, however, they make good use in illustrating their long connection with Admiralty work. Antiquity is written upon the full-rigged model of the sloop-of-war *Prince of Wales,* built for the British Government by the Co.'s forbears, John Scott & Sons, in 1803. There is quite a living interest attaching to the obsolete H.M. gunboat *Thrush,* 805 tons, 1,200 horse power, carrying 6 guns; because this craft was commanded by H.R. Highness Prince George of Wales, now His Majesty George V. A full model of the modern battleship *Argyle,* built in 1905, and pictures of other notable productions complete the exhibit.

MESSRS. JOHN BROWN & CO., LTD., Clydebank, associate themselves with their friends THE CUNARD CO., in a very prominent stand in the Hall of Industries' section of the Exhibition, where almost as much space is devoted to shipping exhibits as in the Kelvin Hall, but which are placed by shipowning companies and travel agencies, and are accompanied of course by wealth of photographs of scenery, fac-similies of staterooms, and other accommodation, etc. Prominent on the large stand is a magnificent model of Clydebank's most notable production the *Lusitania,* which even in miniature form impresses the visitor with its sense of power, speed, and luxuriousness. Adjoining the model is a full size replica of a first-class stateroom on the Cunard liners. On the same stand Messrs. Brown & Co. put in evidence a fine example of their achievements in naval ship construction—a highly finished model of the British armoured cruiser *Inflexible.* Another Clydebank production—still on the stocks however—is the Orient liner *Orama,* of 13,000 tons and 18½ knots speed, and a splendid model of this addition to the Orient fleet is shown at the adjoining stand of Messrs. Thomas Cook & Son, the tourist agents.

MESSRS. YARROW & CO.'S stand, which is arranged as a historical record of the firm's achievements, is not large, but is full of interest. The walls of the stand are tastefully hung with pictures which illustrate Messrs. Yarrow's most noteworthy productions in various classes of shipbuilding and boiler work. These pictures are so arranged as to show the earliest and latest production in each type of vessel. There is a photograph of the *Hornet,* one of the earliest torpedo-destroyers, side by side with one of the ten latest destroyers built for the Brazilian Government, and one of the Yarrow-Napier motor launch at the Naval Review of 1905. In this vessel the late King Edward, Queen Alexandra, and the King and Queen of Spain took a run, which speaks volumes for the confidence put in the boat; one of the stern-wheel steamer *Stanley,* built for the famous explorer. This vessel was portable, and was taken by Stanley on his ascent of the Congo. There is a photograph of a shallow-draft, twin screw gunboat; one of an up-to-date stern-wheeler; and a composite photo of the Yarrow-Napier torpedo boats. There is a photo showing examples of the well-known Yarrow boiler

now adopted in war vessels of all kinds—from the 60 ft. torpedo to the super-Dreadnought. Effectively arranged on one of the walls are a series of transparencies showing the evolution of the torpedo boat destroyer from the steam launch of 1868 to the up-to-date destroyer of 1910. The pictures indicate the prominent part taken by Messrs. Yarrow in that class of work during the last 40 years at least. Among the many models there is one of the *Hornet* above noticed; one of a sea-going destroyer; apparatus for ascertaining the depth of water by means of the inclination of the vessel, and a model of stern-wheeler *Mosquito*, built for British Government, one of the first vessels to sail up the Zambesi, thus establishing British right to navigate that river. One of the most interesting items on the stand is a model of Messrs. Yarrow's works at Scotstoun, to which the firm removed in 1908, for the purpose of better economic and industrial conditions, and better facilities for the trial of high-speed vessels. All the Brazilian destroyers were built here, and the company at present have five large destroyers on hand for the British Admiralty. All the vessels represented by photo or model were constructed and engined entirely by Messrs. Yarrow.

(To be continued.)

REVIEWS.

Kelly's Customs Tariffs of the World, 1911. London. Kelly's Directories, Ltd.

THE present edition of this book, though printed in very small type, extends to over 1000 pages, and in the course of six years, owing to the frequency with which tariffs are remodelled and extended, over 250 pages have been added. There is no other book published which gives such full information on the subject as this directory, and its compilation reflects much credit upon the publishers. The book is intended to meet a real and distinct need of the commercial and industrial world, both at home and abroad, as it enables a merchant to tell the duty, if any, levied in any country on any exported or imported article. In many cases two tariffs are given side by side, the general tariff and the "conventional" tariff. The general tariff applies in the cases where reciprocal advantages under the most favoured nation treatment do not exist between two countries. The directory contains the latest information available, and includes the new Swedish and Japanese tariffs to come into force on Dec. 1st, 1911, and July, 1911, respectively. The proposed Reciprocity Tariff between Canada and the United States of America is given in full.

BOOKS RECEIVED.

A Handbook of Testing—Materials. By C. A. M. Smith, M.Sc. (Eng.). Price 6s. nett. London: Constable & Co., Ltd.

Electric Wiring Fittings, Switches and Lamps—Circuits. By W. Perren Maycock, M.I.E.E. 4th edition. Price 6s. nett. London: Whittaker & Co.

Design and Construction of Ships (Vol. II., Stability, Resistance, Propulsion, and Oscillations of Ships). By Prof. J. H. Biles, LL.D., D.Sc. Price 25s. net. London: Charles Griffin & Co., Ltd.

Engine Room Practice. By John G. Liversidge, Eng.-Comm. R.N. 7th edition. Price 6s. net. London: Charles Griffin & Co., Ltd.

MESSRS. WAILES, DOVE & CO., LTD., have just issued a catalogue of their "Bitumastic" preparations. The firm is exhibiting at the Glasgow Exhibition.

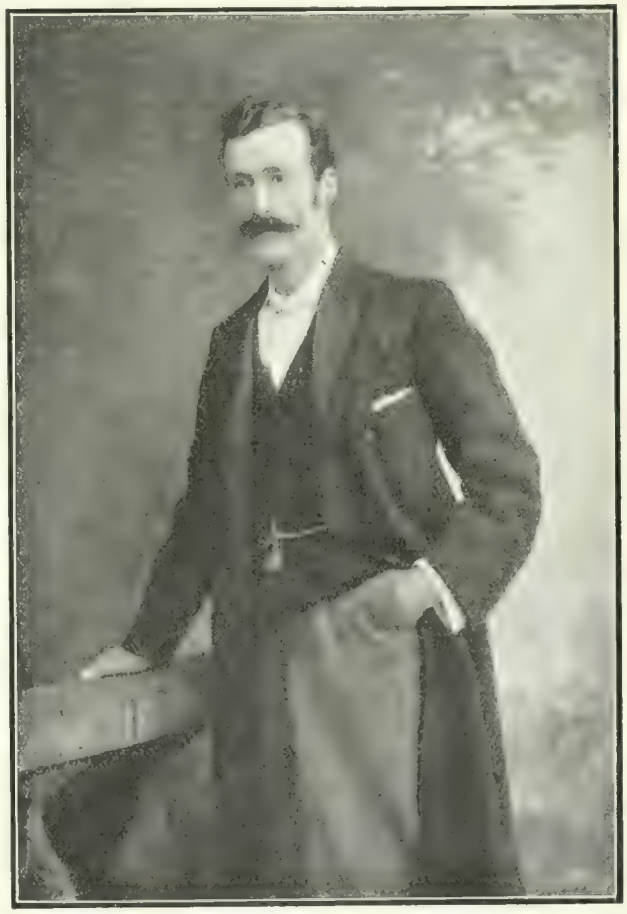
THE "SHENG TA."—A Cochran (Annan) donkey boiler with patent seamless furnace has been supplied and fitted on this vessel, which was launched from the yard of Messrs. Napier & Miller, Ltd., Old Kilpatrick, on April 28th.

THE WILLETT BRUCE AUTOMATIC WHISTLE CONTROL.—After twelve months' experience of the Willett Bruce Automatic whistle control, we understand that the managers of the Bibby Line have given instructions for the whole of their fleet to be fitted with this system, including the new ship now completing at Messrs. Harland & Wolff's works.

OBITUARY.

John Preston.

THE announcement of the death of John Preston, superintendent engineer of the General Steam Navigation Co., Ltd., on May 12th, was received with deep regret and painful surprise by his many friends and acquaintances. He was occupied by his duties in the beginning of the week and after a few days illness he succumbed under pneumonia. The funeral was attended by a large number of friends, of representatives, and the workmen from the works at Deptford, all evidencing the esteem in which Mr. Preston was held. The Rev. Geo. Elder, St. Mark's Presbyterian Church, conducted a short service and referred to the kindly nature of the member they had lost, and to the general respect accorded to him. Born in Perthshire in 1857, on the termination of his school days at Perth, he went to Aberdeen, where he



The late John Preston.

served his apprenticeship with Messrs. Hall, Russell & Co. He afterwards went to sea and then obtained an appointment at Singapore as assistant manager. He subsequently was employed at the Caledonian Railway Works, St. Rollox. His next appointment was as manager to Messrs. Scott & Co., Kirkcaldy, the builders of several vessels for the General Steam Navigation Co. This connection led to his appointment as assistant to Mr. T. Wilson—whom many of our readers may remember as the superintendent—on whose death some twenty-one years ago Mr. Preston was appointed to succeed. A member of the Institute of Naval Architects, of the Institute of Metals, Mr. Preston was also a member of Council of the Institute of Marine Engineers, having been elected to office in 1910. We join with their many friends and acquaintances in expressing our regrets and in offering our sympathetic condolences to the widow, her sons and daughters.

Captain Arthur Wellesley Bremner.

The death took place on May 1st of Captain Arthur Wellesley Bremner, who for over 23 years held the position of superintendent of the training ship *Indefatigable*, stationed in the Mersey. About three months previously Captain Bremner suffered a paralytic seizure, from which he partly recovered. The captain was born in Liverpool in 1844, and at the age of 14 years was apprenticed to Messrs. Jones Palmer & Co. Later he joined the service of Lamport and Holt, and later to see service with the West India and Pacific Steamship Co. in 1870. After eleven years he joined the Guion Line. In 1884, while in command of the *Nevada*, fire broke out in the cargo of cotton when 475 miles from Queenstown. After a desperate struggle, during which Captain Bremner was thrice rendered unconscious, he finally brought his vessel into Liverpool. For this act he received medals, and votes of thanks from Lloyds and other societies. He was instrumental in securing the training brig *Jas. J. Bibby* for giving the boys, which now number 240, sea experience. This vessel was built in 1901. Captain Bremner was in his 67th year and leaves a widow.

INSTITUTION OF NAVAL ARCHITECTS.—The programme of the proceedings at the International Congress of Naval Architecture and Marine Engineering, to open on July 3rd, was given in our May issue.

MESSRS. MUIR, TILSTON & CO., of Glasgow, consulting engineers and marine surveyors, have opened an office in Buenos Aires, which will be under the conduct of Mr. Tilston. Their services will be available in South America after the 20th May.

AN ELECTRICAL EXHIBITION incorporating engineering and machinery is to be held at Olympia, London, September 23rd to October 21st, 1911. It is promoted by the National Electrical Manufacturers' Association, and the President will be Sir W. H. Preece, K.C.B., F.R.S.

THE "C.M.P. GATESHEAD" STEAM WHISTLE CONTROL AND DRAIN VALVE.—Some important orders have been placed with the "Combination" Metallic Packing Co., Ltd., Gateshead, for their "C.M.P. Gateshead" Steam Whistle Control and Drain Valves, complete with newly designed steam whistles and syrens. These "C.M.P." Drain Valves are now a recognised fitting, and some hundreds of valves are already in use. We understand that this firm has one single order in hand for fitting out a fleet of no less than twelve vessels.

MERCHANT SEAMEN'S ORPHANAGE.—The sixteenth annual excursion in aid of the funds of this Institution is to take place on Thursday, June 15th. The general steam Navigation Co.'s steamer *Eagle* has been granted for the occasion, and those who can spare the day to have a blow beyond the confines of the river Thames will have an opportunity of enjoying themselves and aiding in a good and worthy cause by taking tickets. The price for the outing is 10s. each for ladies or gentlemen, including luncheon on board and rail from Tilbury to London in the evening for the return journey.

SHIPPING IN JAPAN.—Referring to the report of shipping recently issued by the Director of the Mercantile Marine Bureau, and referred to in our May issue, an English translation of the report for the year 1909-1910 states that there were 2,366 steamers of 1,198,194 tons gross, 5,937 sailing vessels of 404,089 tons gross, and 22,734 junks of 3,013,494 koku capacity, showing an increase over the preceding year of 62 steamers of 37,754 tons, and of 558 sailing vessels of 19,608 tons, and of 1,027 junks of 196,264 koku. Of the registered vessels the increase, owing to new construction or other causes during the year, was 86 steamers of 66,995 tons, 506 sailing vessels of 31,204 tons and 632 junks of 202,724 koku. On the other hand, the number of vessels lost by sea disasters and other causes was 51 steamers of 29,777 tons; 192 sailing vessels of 16,240 tons, and 87 junks of 41,103 koku. At the end of the year 239 shipbuilding yards were in existence, not counting junk builders, the number of vessels turned out being 58 steamers of 63,475 tons, and 205 sailing vessels of 15,616 tons. The number of ships and other craft entering and leaving the ports where harbour regulations of the open ports are in force, namely, Yokohama, Kobe, Nagasaki and Moji totalled 51,174, aggregating 80,696,175 tons. This was a decrease of 2,128 vessels, aggregating 1,471,281 tons, as compared with the previous year.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(*From our Own Correspondent.*)

Launches, Recent and Prospective.—The month of May, like April, has added very considerably to the output of tonnage from Clyde shipyards, the contributary items in a number of cases being most notable productions. The April returns brought the year's output, so far, up to 84 vessels aggregating 163,540 tons, contributary items being the twin-screw steamer *Shropshire* of 11,000 tons, by Messrs. John Brown & Co., Ltd., Clydebank; H.M. second-class cruiser *Yarmouth* of 5250 tons by the London & Glasgow Shipbuilding and Engineering Co., Govan; the torpedo boat destroyer *Fury* of 780 tons, having turbines of 13,500 i.h.p., by Messrs. A. & J. Inglis, Pointhouse; and the many-decked, twin-screw Canadian river steamer *Saguenay* of 3000 tons by the Fairfield Co., Govan. May's contributions had an exceptional lead off with the battleship *Conqueror*, launched on May 1st from the Dalmuir works of Messrs. Wm. Beardmore & Co., Ltd., which swelled the aggregate by no less than 22,500 tons. Another contributory item of importance was the 10,000-ton anchor, liner *Cameronia*, sent off the stocks of Messrs. D. & W. Henderson & Co., Meadowside, on May 27th. This vessel is the fourth "C" class Anchor Liner to be added to the fleet, the others being the *Caledonia*, *Columbia*, and *California*, all built at Meadowside. The Fairfield Co. have at present in a well advanced state and will shortly launch the Union Castle Co.'s liner *Gloucester Castle* of 8000 tons, a sister ship being also well advanced in the shipyard of Messrs. Barclay, Curle & Co., Ltd., Whiteinch.

Messrs. Wm. Beardmore & Co., Ltd.—The *Conqueror* was launched on May 1st, as referred to in another column and the cruiser *Falmouth* had been ready for her steam trials for some time—three months in advance of her contract date—and now they are waiting instructions from the Admiralty to proceed further with that vessel. The keel of H.M. cruiser *Dublin* is now laid in the Beardmore yard, and other berths are being occupied with steamers for merchant service.

New Contracts.—Messrs. Alex. Stephen & Sons, Ltd., of Linthouse, have received an order from the British India Steam Navigation Co. for a steamer of 4000 tons gross, a duplicate of the *Abhona* (built by the same firm) which was lost in the Bay of Biscay last year while on the trip out to make her maiden voyage in the Eastern trade. Several steamers have been launched and completed on the Clyde for the British India Co. during the past few months.

The Greenock & Grangemouth Dockyard Co., Greenock, have contracted with Messrs. J. Hardie & Co., Glasgow, to build a steamer of 7200 tons carrying capacity similar to the same owners' steamer *Caldergrove*. Engines and boilers will be fitted by a Greenock engineering firm.

Messrs. D. J. Dunlop & Co., Port Glasgow, whose shipyard does not give evidence of any great activity, are proceeding to lay down an oil-carrying steamer of moderate dimensions, 165 ft. length of keel, to the order of the Anglo-American Oil Co. The machinery will also be supplied by the builders.

Messrs. Wm. Simons & Co., Ltd., Renfrew, on May 16th launched a twin-screw hopper suction dredger of 2000 tons carrying capacity, named the *Labrus*, a detailed description of which will be found in the "Launches" section of this issue. She is the nineteenth dredger which Messrs. Simons and Co. have built for work at Durban. A recent order consists of three large dredgers of the sand-pump suction type for the Government of Burmah. These are to be capable of dredging to a depth of 40 ft., and are to be fitted with a rotary cutter for breaking up the heavy soil and preparing it for reception by the suction nozzles.

Messrs. Lobnitz & Co., Ltd., Renfrew, in addition to a large number of craft of lesser capacity, are proceeding to lay down the powerful bucket dredger recently ordered from them by the Clyde Navigation Trustees, as also the first two of the four hopper barges, each of 1200 tons capacity, for carrying away the dredged material from this and the other powerful dredgers presently in the thick of widening and deepening the river in the neighbourhood of Clydebank and Dalmuir.

Messrs. Fleming & Ferguson, Paisley, have received an

order from the Tyne Improvement Commissioners for a bucket dredger to be employed in the deepening and improvement of the river Tyne. The firm have also received an order for a dredger for the Bombay Port Trust, and an order for engines and machinery for a dredger to be built abroad. The Paisley firm is now proceeding with the construction of two large bucket-ladder dredgers, designed to dredge from a depth of 45 ft., for the Port of London Authority, and a third dredger for the same concern is undergoing completion at their works.

Messrs. William Denny & Brothers, Leven Shipyard, Dumbarton, have received an order for a turbine steamer for service between Stranraer and Larne, the machinery for which will be supplied by the associated engineering firm of Messrs. Denny & Co., Dumbarton.

Messrs. The Greenock and Grangemouth Dockyard Co. have obtained an order for an oil-carrying steamer for London owners, the machinery for which will be supplied by Messrs. Rankin & Blackmore, Greenock.

Messrs. George Brown & Co., Garvel Park Shipyard, Greenock, has received from Mr. E. Radonicich, Glasgow, an order for a twin-screw steamer, to carry about 1000 tons on light draught, intended for trading in South American waters.

Advance in Wages.—The supply of labour in the iron-working sections of shipyards and boiler shops, almost ever since the resumption of work following upon the lock-out has been inadequate to the demand, and a reflex of this is seen in the arrangement which has been come to between workmen and employers for an advance in wages. As the result of a conference held in Glasgow on May 17 between representatives of the North-Western Engineering Trades Employers' Association and the Boilermakers and Iron and Steel Shipbuilders Society, the following advance was conceded and has been accepted by members of the Boilermakers Society :— One shilling per week or ¼d. per hour where payment is made by hour on time rates, and 2½ per cent. on piece rates ; the advance to take place on May 31st, June 1st and June 2nd as the pays commence. The enhanced rates are to remain undisturbed for a period of six months, and any subsequent alterations are to be subject to the usual one month's notice on either side. It was further agreed that future general fluctuations should be of the above amounts. The advance affects 5000 on the Clyde and meantime only affects that district.

New Harbour Facilities at Aberdeen.—Harbour facilities for the repair and overhaul of ships as well as for fitting out new vessels, consisting of the 100-ton shears just completed, and the floating dock to accommodate ships 300 ft. in length, which is very shortly to be towed from Barrow-in-Furness, where it has been constructed, have recently been in hand at the Port of Aberdeen. The shears, designed and constructed by Messrs. Day, Summers & Co., Ltd., Southampton, have been erected and tested within five months of the date of order. They are fitted alongside an older and less powerful set by the same makers which, in 1874, were erected and tested to 80 tons. A feature of the new shears is that they are electrically driven, the motors having been supplied by Messrs. J. H. Holmes & Co., of Newcastle-on-Tyne. The front legs are 130 ft. long and the back leg 170 ft. long ; and there are two hoisting winches, one being capable of raising weights up to 100 tons to a height of 80 ft., and the other weights up to 30 tons, with a very quick lifting speed to a height of 30 ft. The traversing gear for working the legs is driven by an independent motor of 100 b.h.p. fitted with a reversing controller and solenoid brake, the latter automatically stopping and holding the motor directly the current is cut off. The screw for altering the angle of the legs is 60 ft. 6 in. long by 9½ in. diameter, Messrs. Firth & Sons, Sheffield, having supplied the rough forging from which it was machined. The floating dock is designed to lift ships ranging in length up to 350 ft., in breadth to 66 ft., and in displacement to 5250 tons : but it is so arranged that a number of steam trawlers may be docked simultaneously. It consists of two parallel side walls and a deep double bottom made up of interchangeable pontoons six of which are attached to the side walls. The overall length of dock is 310 ft., and overall breadth 90 ft., while the clear breadth between rubbing timbers is 66 ft. 6 in. The overall height of side walls and pontoons is 45 ft. 9 in., the depth of pontoon being 12 ft. 6 in., while the length of each pontoon is 50 ft. The pumping machinery consists of an installation of horizontal centrifugal pumps driven by vertical electrical motors, while an electric travelling crane of 5 tons capacity traverses the whole length of the side wall. Current for working the various motors and for lighting the dock will be supplied through a cable from electric mains on shore. The dock itself will be moored to the shore by cables and by three lattice booms hinged at one end and to dolphin posts on shore.

THE TEES AND HARTLEPOOLS.

(From our Own Correspondent.)

Middlesbrough.

Messrs. Sir Raylton Dixon & Co., Cleveland Dockyard.— This eminent firm keeps fairly busy, having an amount of work on hand sufficient to keep them busily employed throughout the year.

Messrs. W. Harkess & Co., Ltd., are very busy, all berths being occupied, and with repair work on hand they will be kept fully employed for some months to come.

Messrs. Craggs & Co.'s yard, which was recently put up for auction, has been sold. It will be dismantled for the building of warehouses, which will mark the entire disappearance of a once most prosperous firm.

Messrs. Smith's Dry Dock Co., South Bank, are very busy, they now make the engines as well as the boilers for the various steamers they build ; they are also busy in the repair and dry dock department.

Messrs. Richardsons, Westgarth & Co., Ltd., keep fairly busy. They are reported to have secured a contract for foreign account which, with the work booked and on hand, must keep them busy well into next year.

Stockton and Thornaby.

Messrs. Richardson, Duck & Co. are reported to have secured a contract to build a medium-sized cargo steamer which will help them into next year, being fairly well booked up.

Messrs. Craig, Taylor & Co. keep busy with work on hand, but nothing new is reported during the month.

Messrs. R. Ropner & Sons are now fairly busy having a fair amount of work on hand, but are not so well booked up as they might be.

Messrs. Blair & Co. are very busy, they are reported to have fifty-three contracts for engines and boilers which, it is said, they expect to deliver in thirteen months, overtime being worked in every department ; this, I think, will constitute a record for this firm, and will at any rate be a splendid performance.

Whitby.

Messrs. The Rowland & Marwood S.S. Co., Ltd., recently sold the s.s. *Wennington Hall*, of 2947 gross tons to Messrs. G. A. Shaw & Co., Newcastle-on-Tyne, which is reported as resold to foreigners.

During the month a notable piece of work has been completed, being the transporter bridge at Middlesbrough over the Tees with a span of 570 ft. and 160 ft. high from the river to the underside of the bridge. It has been constructed under the superintendence of S. E. Burgess, Esq., the borough engineer, by Messrs. Arrol & Co., contractors, Glasgow.

West Hartlepool.

Messrs. Furness, Withy & Co. have recently bought the German steamer s.s. *Johanna Oelsner* of 858 gross tons from Messrs. Guhard & Hay, Hamburg, for about £4000. They have recently sold the s.s. *Anna* of about 3500 tons deadweight to foreigners.

Messrs. W. Gray & Co. are reported to have booked an order from France and are well off for work, and with some other firms are marking time for a rise in prices.

Messrs. Irvine's Shipbuilding and Dry Dock Co., Harbour Dockyard, keep very busy ; they will shortly launch one of the largest steamers ever built at this yard, and have also booked orders for other two small cargo steamers for Belgian owners. They are also very busy with repair work.

The Central Marine Works of Messrs. W. Gray & Co. are very busy with work on hand and are reported to have secured an order for foreign account. They are exhibiting one of their specialities, forge stampings at the Manchester Exhibition.

Hartlepool.

Messrs. Irvine's Shipbuilding and Dry Dock Co., Middleton Yard, maintain a very busy appearance; they are reported to have booked contracts for two large cargo steamers and expect to secure an order for Messrs. Houlder Bros. for their "transport" line. They have a very large repair job on hand, the s.s. *North Point*, belonging to Messrs. Furness, Withy & Co., which has been on fire and so severely damaged that it is expected that at least two of her decks will have to be renewed.

Messrs. Richardsons, Westgarth & Co., Ltd., are very busy, overtime being worked in most departments. It is rumoured that they have booked the contract to supply the engine and boilers for the steamers to be built at both the Dockyard and Middleton yards of Messrs. Irvine's Shipbuilding and Dry Dock Co., they are also very busy in the condensing department of which they have a very excellent exhibit at the Glasgow Exhibition.

THE HUMBER AND DISTRICT.

(From our Own Correspondent.)

Earle's Shipbuilding and Engineering Co., Ltd., are very busy with general repair work, on several local and outside steamers, their patent slips have been fairly employed, on damaged bottoms, etc. They have recently launched the *Stockport*, the last of the five vessels ordered for the continental services of the Great Central Railway Co. (passenger and cargo service). The *Stockport* has been built to Lloyd's survey 100 A1 class, and to the Board of Trade latest rules, also in accordance with the German emigration laws and requirements. The vessel is provided with all the latest cargo gear and appliances for quick loading and discharging. Complete installation for steam heating, electric lighting, bells and telephones have been supplied. The R.M.S. *Bavardo* for the Wilson line, Norwegian and Hull service, will have been launched by the time this notice appears. She is to be fitted with powerful propelling machinery to develop a high sea speed and will make weekly voyages to Christiania and Hull. She is to be fitted up as a first-class steamer, and is expected to take her station in July in the height of the passenger season.

Messrs. Amos & Smith, Ltd., Engineers and Boilermakers, Albert Dock Works, are fully employed working night and day to execute the orders they are entrusted with. They have been successful in securing further orders which will extend to next year for boilers and machinery for Grimsby and Hull trawler owners. The outside staff are very busy with general overhauling, opening out boilers and machinery for Board of Trade, Lloyd's and Corporation surveys. The branch shop (Alexander Dock) is fully employed in general repair and dry dock work.

Messrs. C. D Holmes & Co., Ltd., Engineers and Boilermakers, are keeping busy at their works in English Street, and will be kept employed for the next few months building boilers and engines for trawlers and drifters for local owners and others. They are also busy building and completing orders for their patent large compound winches. The branch shop (Alexandra Dock) is receiving a fair amount of general overhauling work and dry-dock work.

Hull Central Dry Dock and Engineering Works, Ltd.—This firm has abundance of work and the staff have been fully taxed on the following steamers in the firm's dry dock—*Halydan*, *Tees*, *Liberty*, *Algores* and *Monica*, and in the N.E.R. Co.'s dry dock situated at Albert Dock *Cherrybrook*, *Teutonic*, *Pretoria*, H. & B. R. Co.'s Alexandra Dock (dry dock) *Olympic*, *Dunholme*, *Tanfield*, *Hillglen*, *Asiatic*, *Antonio* and *Kartoum*. Several of the mentioned steamers have had heavy damage repairs, and put through Lloyd's and British Corporation surveys, the others the usual general overhauls.

North-East Coast Engineering Works (Hull), Ltd., are keeping fairly busy with overhauling, deck and the usual engine-room repairs on the following steamers—*Saga*, *Bard*, *Gustaf*, *Adolph*, *Aurora*, *Margaretha*, the towing barge *Clara*, steam towboats *Winchester* and *Southern Cross*, and the *Foxley*. The *Goosebridge* and the two latter vessels undergoing heavy repairs. The *Kyleness* is undergoing extensive repairs, and is also to be dry-docked for scraping, cleaning, painting, sighting bottom, and refitting new propeller. The company's new boiler shop is nearly completed and is fitted up with the latest type of machinery. They are now in the position to execute heavy repairs on hulls of steamers, etc. Several orders have been booked in advance for overhauling and dry-docking steamers coming to the port.

Messrs. Cooper & Co., Ltd., Engineers and Boilermakers, Neptune Engine Works, are working at high pressure, having a number of steamers going through their annual survey for Lloyd's and Board of Trade, and in some cases of extensive repairs to hulls, etc. The moulding shop is very busy with home and foreign orders for propellers, etc. The branch (Alexandra Dock) shop is fairly busy with steamers opening out for surveys and dry docking of steamers. The Union Dry Dock, belonging to this company, is fully employed with coasting steamers and tug boats, and doing extensive hull repairs, etc., on several of them.

Messrs. Woodall & Co., Engineers and Boilermakers, have had a fair amount of work on several coasting steamers in the shape of engine and deck repairs, and also in erecting two hydraulic cranes on the old harbour side for Messrs. John Good & Sons. Orders have been obtained from the Government for forgings, from the London County Council for the firm's patent Handibloc, and from a London firm of shipowners Handiblocs for two new steamers building. Several members of the outside staff have been employed in the Hull Corporation power tram station overhauling the machinery.

Fish-Dock or St. Andrew's Dock.—The repairing shops around this dock are very busy at present overhauling steam trawlers and putting same through survey for Lloyd's.

Messrs. Cochrane & Sons, Shipbuilders, Selby, are very busy building and fitting out trawlers and drifters, and have been successful in securing further orders for local and other owners.

Messrs. Cook, Welton & Gemmell, Shipbuilders, Beverley, are very busy on new work, trawlers, etc., the carpenters, department working overtime to assist in delivery of vessels. Further orders have been secured from Grimsby and Hull owners.

SOUTH OF ENGLAND AND ISLE OF WIGHT.

(From our Own Correspondent.)

THE White Star Co.'s *Olympic* is due at Southampton on the 3rd of this month, and arrangements are now well advanced toward giving the vessel a reception worthy the occasion. All efforts are now being centred on the berth in the new wet dock, and the work on the berth and sheds is in an advanced state. The vessel is to be thrown open for public inspection on the 10th, when a record demand for tickets is anticipated. She is due to sail on her maiden voyage on the 14th of the month.

Messrs. J. I. Thornycroft & Co., Ltd., Woolston Works, Southampton.—H.M.S. *Minstrel* was delivered into H.M. Service on the 13th of last month, and H.M.S. *Acheron* was successfully launched on the 27th of the month. H.M.S. *Ariel*.—Last month the work of testing the water-tight compartments was completed. Stern wheel passenger steamer for Persian Gulf.—This vessel has carried out successful official trials, a speed of about a knot more than was required by contract being maintained. She will be shipped early this month. Armoured Patrol Boats.—The first of these boats made a preliminary run early last month, when the contract speed was exceeded by about a knot. Two of the boats were shipped towards the end of the month. The Repairs Department have had a busy month, and the usual number of small jobs were going through the shops.

Messrs. J. Samuel White & Co., Ltd., East Cowes, I. of W.—H.M.S. *Ferret*, torpedo-boat destroyer of the 1910-11 naval programme, recently launched, received her boilers and turbine machinery last month, and is now fitting out. H.M.S. *Forester*, sister-ship to the *Ferret*, will be put into the water at an early date. Two Revenue Steamers for a Foreign Government are being constructed by the firm, and are making good progress. The Boatbuilding Department is fully occupied with home and foreign work.

Messrs. Simpson, Strickland & Co., Dartmouth, S. Devon.—This firm are well employed on new and repair work, also with fitting-out work for the season. Two fine mahogany steam launches have recently been despatched to Clydebank

for the new s.y. *Jeanette*. A 50-ft. steam pinnace for the Admiralty was recently delivered to H.M. Dockyard, Devonport, and another similar boat is nearing completion. Other work for the Admiralty includes a 30 ft. steam cutter for one of the Royal Yachts, and 35 ft. and 28 ft. motor launches. Three 35 ft. steam cutters for the Admiralty have recently been delivered to various vessels. New work in hand includes a steam launch for Mr. Wm. Garfit's s.y. *Mavis*, and five boats for a yacht building at Leith for H.S.H. The Archduke Charles Stephen of Austria. A 23 ft. steel launch for South America is in hand, and will be fitted with the firm's petrol motor. The s.y. *Kathleen* has had a large amount of cabin alterations carried out during last month. A very fine 25 ft. yacht's launch for H.M. the Prince of Monaco has just been despatched. This boat is fitted with closed-in triple engines and an oil-fired boiler. Several sets of machinery and boilers have recently been delivered, among others in hand being complete machinery for four twin-screw vessels.

Messrs. Day, Summers & Co., Ltd., Northam Iron Works, Southampton.—Last month this firm shipped a set of sheer legs and screw to lift weights of 25 tons to South America. These have been constructed to the order of Messrs. C. H. Walker & Co. The new paddle-steamer to the order of the South of England and Isle of Wight Steam Packet Co., to be named the *Princess Mary*, is rapidly approaching completion. The s.y. *Capercailzie* has had the old boiler lifted out, and the new boiler constructed by the firm will shortly be fitted. The s.y. *Medusa* (640 tons), Mr. Alfred Farquhar, has returned from the Mediterranean and is being painted. The s.y. *Lady Evelyn* has had her steam engines refitted, and carried out a number of trial runs last month. The s.ys. *Vanduara*, 450 tons, and *Madrigal*, 149 tons, both left the yard in Commission last month, and the *Gelert*, 122 tons, was going through survey preparatory to fitting out.

THAMES.

(*From our Own Correspondent.*)

The Port of London Authority.—This body having settled down to its work has taken in hand the dredging of the Thames channel as recommended by the Royal Commission in 1902. This was for a channel 30 ft. deep from the sea to the Royal Albert Dock and 1000 ft. wide from the Nore to Crayfordness and 600 ft. from Crayfordness to the Albert Dock. The Authority considers that so much of the trade is done up to London Bridge that it is imperative that the improvement of this channel shall also be undertaken. The further work to be taken in hand is a channel 20 ft. deep and 600 ft. wide from Albert to Greenland Dock and 16 ft. deep and 500 ft. wide from the Greenland Dock to the Thames Tunnel, 14 ft. deep and 500 ft. wide from the Thames Tunnel to the Tower Bridge and 14 ft. deep and 450 ft. wide from the Tower to London Bridge. That this scheme is most ambitious will be readily seen, and a great improvement to the port. From Tilbury downwards the channel has already been completed with the exception of that through Yantlet Shoals, where the depth is only 27 ft., and upon which the suction dredger *Lord Desborough* is now engaged. From Tilbury to the Albert Dock a good deal remains to be accomplished, certain parts being only 16 ft. to 18 ft. at low water in the Barking reach. The dredging fleet when complete will consist of five large suction dredgers, six bucket ladder dredgers and twenty-one hopper barges for conveyance of the material dredged to the sea. The total cost of this plant will be £650,000, of which £430,000 is for plant now being constructed by the Authority.

Shipping Companies.—The P. & O. Co. has declared a dividend of 5 per cent. on the preference stock and an interim dividend of 7 per cent. on the deferred stock for the half-year ending March 31, the same rate as a year ago. The Royal Mail Co. has recommended a dividend for the year ending Dec. 31 last at the rate of 2½ per cent., making with the interim dividend 5 per cent. on the preference stock and a dividend of 4 per cent. on the ordinary stock as compared with 3 per cent. for 1909. The Shaw, Savill & Albion Co., Ltd., has a dividend of 5 per cent. on the A and B stock, leaving a balance of £8,686 to carry forward. The new vessels *Rangatira* and *Pakita* were added in 1910, and a new boat, the *Waimana*, is ordered. The Royal Mail Co. are building at Messrs. Harland & Wolff's three new twin-screw boats each over 10,000 gross register, to be named *Descado*, *Demerara* and *Desna*. These will be employed on the Company's intermediate South American service.

Shipping Legislation.—Nearly forty firms have waited on the President of the Board of Trade with their views as to Colonial Merchant Shipping regulations. The interview was in anticipation of the Imperial Conference shortly to be held here. The views expressed were as to the necessity of Imperial legislation for oversea shipping. The President's answer was so far satisfactory as to his endeavour at the forthcoming conference.

The St. Paul's Bridge.—This matter has come before the House of Commons Committee. This bridge will be of five spans and 80 ft. wide. Southwark Bridge, which has a gradient of 1 in 18, will be altered so as to give 1 in 32·7. The cost of the scheme in its entirety will be about 2¼ millions. The bill was ordered to be reported.

British and Foreign Sailors.—The Lord Mayor presided over the 93rd annual meeting of this society, and it was said particular attention had been given to visitation at the docks. It was satisfactory to note the Nautical School flourishes, and out of 544 masters and mates who passed in London last year no fewer than 243 were students at King Edward VII. Nautical School. The income for the year was £34,584.

MERSEY AND MANCHESTER SHIP CANAL.

(*From our Own Correspondent.*)

AS the various Admiralty contracts progress, more employment is being found in the Mersey district, more labour being needed as the construction proceeds. Work is also progressing at the new Gladstone Docks, huge excavations have already been made, and when completed the dock area will extend further seaward, thus increasing the enormous dock front.

Messrs. Cammell, Laird & Co.—Following the recent increase of important contracts secured by this firm various important changes have followed in the organization of the firm. Under the new chairmanship of Mr. Wm. Lionel Kitchen various energetic steps are being taken to cope with the increasing activities of the company. Mr. S. W. P. Laird has been appointed secretary to the works, while Mr. Roy Laird will act as manager of the repair department, whose headquarters will be at a suite of offices in the new Royal Liver Building, thus bringing this department in touch with shipowners. These new premises will be the firm's headquarters in Liverpool. Under the general manager, Mr. E. H. Mitchell, Mr. Henry C. Marshall will take up duty early in July as assistant manager of the Admiralty work. Mr. Marshall has been for many years with the Palmers Co., of Newcastle-on-Tyne, and latterly acted as assistant manager and was associated with the building of H.M.S. *Hercules*. Much interest was evinced in the huge turbine casings for the *Audacious*, recently brought from the Herculaneum dock to the yard by the floating crane *Atlas*. The two weighed 70 tons and were supplied by the Brightside Engineering Co., Sheffield, and were the largest ever cast in that city. The work on the cruiser, battleship and floating dock is reaching an interesting stage. The *San Luis* has completed very successful preliminary trials off Skelmorlie, while the *Santa Fé* will also be ready for trials early in June, while the last of these four Argentine destroyers is at the launching stage. The Admiralty tenders *Adamant* and *Alecto* are also ready for launching. The large stern wheeler for the Madeira Mabore Railway Co. for Amazon service has been partly dismantled, her sides built up and is being towed to Madeira, where she will be taken over by a Booth liner. The steamer for the Nourse Company is also ready for launch. An order for a tug boat has been placed by the port of London Authority for the Thames, while a steamer about 300 ft. long is to be built for the London and North-Western Railway Co. for the Irish service, to be fitted, it is understood, with turbines and water-tube boilers. Several ships have been in for repairs.

Messrs. H. & C. Grayson have been very busy with work on steamers for the summer trade and in this connection the Lancashire & Yorkshire Railway Co.'s steamer *Duchess of York*, *Cornwall* and *Lancaster* has just been reboilered, besides other repairs. The Great Western Railway Co.'s steamer *Great Western* has been in for general repairs. The

Pacific Steam Navigation Co.'s tender is now ready for landing at Garston.

Messrs. Abdela & Mitchell.—Work has been fairly brisk at the river Dee works, Queensferry. A twin-screw passenger steamer of 650 tons is about to be launched. Two large tugs for South America are well advanced. Six steel lighters of 300 tons capacity are on order, while a steel launch has just been shipped to the west coast of Africa. Negotiations are pending for acquiring more land to the north of the present works, while more machinery has recently been laid down for engine building. This firm also have works at Gloucester.

Imperial Merchant Service Guild.—Captain Andrew Tugenna Mutton has recently retired, having acted as treasurer for many years. He left the firm of R. Singlehurst, and after further sea service extending over forty years, he joined the staff in 1898, having ably supported Captain Moore in starting the guild. The funds being £1,000 as the beginning, they are now £32,000.

Diesel Engine for Liverpool Steamer.—Messrs. Job Brothers of Liverpool, have recently ordered a steamer of 180 ft. and 600 tons deadweight capacity from Vuyk & Zonen, Rotterdam. Deisel engines of 150 b.h.p. are to be fitted by Messrs. Thornycroft. These owners' vessels have taken between 40 and 50 days from Newfoundland to the Brazil, due to calms, etc., and it is expected that this new vessel will do the passage in ten days at 7 knots. The vessel will be three-mast schooner rig and will be in commission in September.

Manchester Ship Canal.—Captain Edwards has retired from the post of sailing superintendent of the company at Leuke's Dock after a service of 57 years. The steamer *Ausshnzog Friedrich Franz IV.* left Pernan for Manchester to inaugurate the new service on May 4th.

The Shaw, Savill & Albion Co.—The death has recently occurred at the age of 70 of Mr. Wm. Savill, a partner in the above firm, also of his brother, Mr. Ebenezer Savill.

BELFAST.

(From our Own Correspondent.)

Labour Troubles.—A few weeks since the holders-up in the Belfast yards went out on strike as the result of the riveters' refusal to grant them an increase in the present rate of wages. For many years past the holders-up rate of pay has been 9d. to every 1s. paid to the riveters, and they now demand 10½d., an advance which the latter emphatically decline to concede. Work has, naturally, been somewhat dislocated, but a fair number of squads have been made up with riveters and apprentices, and at the time of writing a good number of the strikers have come in again on the old terms. It is expected that a few days will see the matter settled; meanwhile it is most unreasonable that employers should have to suffer from the result of internal troubles in a trades union society. In cases of disputes (over which the masters have no control) between two branches of the one society, the Executive should insist upon the men remaining at their work pending a settlement. But trades union officials seem now to have little control over the members of their societies.

Messrs. Harland & Wolff.—The finishing touches are being put to the *Olympic*, and by the time these notes are published she will have sailed from Belfast. The launch of her sister ship, the *Titanic*, will have also taken place on the 31st of May. On 25th April there was launched from the north end of the Queen's Island the twin-screw passenger tender *Nomadic*, and on the 27th the twin-screw baggage tender *Traffic*. These vessels have been specially designed for the White Star service at Cherbourg. Both vessels have already been steamed in Abercorn Basin, and their completion is being pushed forward rapidly, with a view to having them ready for attendance on the *Olympic* when she goes down the Lough. Messrs. Harland & Wold have just had completed for them, by the contractors, Messrs. Sir William Arrol & Co., the building of a huge new erecting shop. It is said to be the largest of its kind in the world, the dimensions being—length 750 ft., breadth about 80 ft. between columns, and height 78 ft. The top longitudinal girders will carry two travelling cranes, each having a lifting capacity of 80 tons, while on the lower girders there is a lighter crane to lift 20 tons.

Messrs. Workman, Clark & Co.—On 17th May Messrs. Workman, Clark & Co. added to the number of fruit steamers built by them, and for the construction of which they have become noted. *La Senora* is the name of the latest addition, and a description will be found under the launch section of this journal. Messrs. Alfred Holt & Co.'s recently inaugurated passenger service between Glasgow, Fishguard and Australia has proved so great a success that they have decided to build two new steamers of over 10,000 each, and have placed the contract for the construction of these vessels with Messrs. Workman, Clark & Co. It is stated that they will be similar to the three steamers—*Aeneas*, *Ascanius* and *Anchises*—built by the same firm for this particular service. In addition to these vessels, Messrs. Workman, Clark & Co. have at present in hand for Messrs. Alfred Holt & Co. two smaller vessels of 6700 tons each.

FOREIGN NOTES.

THE NEW STEAMER "PAUL LECAT" OF THE MESSAGERIES MARITIMES DE FRANCE.—This up-to-date and luxurious steamer has been built in the Messageries Maritimes' own shipbuilding yard. The vessel excels in size and speed all steamers which have been built in the Company's yard and has been specially constructed for the mail service to India, China and Japan. The length of the *Paul Lecat* is 528 ft. with a measurement of 12,500 gross tons. Her two engines are of the quadruple expansion type and develop 11,000 h.p. from 12 cylindrical boilers, giving a speed of over 15 knots; at the trials a speed of 17·5 knots was obtained. Accommodation is provided for 452 first, second and third class passengers, and the cabins and general rooms in all classes are fitted up comfortably as regards lighting, hot and cold washing and baths, furniture, accommodation, etc. A wireless telegraph station is also installed.

MOTOR RIVER BARGES.—A motor barge is now carrying out voyages between Paris and Havre. Its dimensions are—length 38·50 metres, width 5·14 metres, draught 1·80 metres, with a cargo of 210 tons. It is manned by only three persons. The oil fuel is contained in two tanks of 2200 litres each, one of 400 litres and a small receptacle of 50 litres of benzine for starting the engine. We are glad to note that the motor is of English make, being from the Griffin Engineering Co. in Bath, and that it works to the full satisfaction of the owners. Various trials were carried out with very successful results. It is expected that several barges will be supplied with oil-motors and also with gas engines and gas producers, for the supply of which English makers are well able to compete, as shown in this instance.

A POWERFUL TUG BOAT, the *Roland*, built in the yard of Messrs. Seebeck in Geestemunde, near Bremen, for the United Tug and Freight Steamship Company, is the most powerful tug boat in Hamburg, or perhaps in all Germany. She is equipped with the latest requirements for towing purposes, and is also able to cope with the most difficult salvage operations. A pump is installed on board capable of pumping 500 tons per hour. She is fitted for wireless telegraphy.

S.S. "AIDA" FOR THE EGYPTIAN GOVERNMENT.—This is an exceptionally interesting steamer and it is to be much regretted that she was not built in one of our shipyards. The Société des Ateliers et Chantiers de la Loire received the order to build the vessel from the Administration of the Ports and Lighthouses of Egypt in competition with other French and foreign shipbuilders. The *Aida* will be used in the service of the lighthouses in the Mediterranean and the Red Sea, and her duties will consist in the transportation of provisions, fresh water, etc. The engines are of the triple-expansion type and develop about 1,200 h.p., which enables the ship to travel at a speed of 13 knots per hour. The steam boilers are three in number of the cylindrical return tube type, and the bunkers are very ample, holding coal sufficient to steam 3,500 knots. She is lighted by electricity. Cold storage equipment for preserving goods of perishable nature is provided. Ample cabin accommodation has been arranged for seventy to eighty passengers, and the officers of the ship.

KOSMOS STEAMSHIP CO.—A meeting of this Company took place recently at Hamburg. In the course of the meeting a shareholder enquired of Mr. Ballin as to the condition of the steamers of the Company. In reply, Mr. Ballin made the important statement that the time had now come when the "Kosmos" would soon have to issue orders for several large steamers.

The introduction of Diesel motors is making great progress in the Caspian Sea, and at present there are four such steamers occupied in the transport of oil products. The first arrived in 1908, this and two others were built in the building yards of the Volga, whereas the fourth was adapted in 1909-10 in Baku by the steam plant being removed and Diesel motors inserted. Their respective sizes are 4,500, 4,750, 4,750 and 2,000 tons, the power of the first three being supplied by twin motors of 600 h.p. each, the fourth having similar motors of 400 h.p. each.

The Hamburg steamer *Johanna Oelsner*, a cargo vessel of 500 tons nett register, has been sold to an English shipping firm.

The English four-masted barque *Dunfermline* has now been rechristened, and received the name *Carl Rudgert Vinnen*, after a member of her present owners, H. C. Schramm, Bremen.

THE TWELFTH INTERNATIONAL CONGRESS OF NAVIGATION will be held in the spring of next year, at Philadelphia, under the auspices of the Government of the United States. Particulars can be obtained of this meeting and also of the objects of the Congress from Mr. L. Serraillier, Queen Anne's Chambers, Westminster, the honorary British representative of the International Association of Navigation Congresses.

INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND.—Mr. Robert Boyle, B.Sc., has contributed a valuable paper to this Institution, *viz.*, "Large power fitting-out cranes, with special reference to electric revolving cantilever cranes." The paper contains numerous illustrations.

AUTOMATIC STOKERS.

The British Niclausse Boiler Co., Ltd., of Caxton House, Tothill Street, Westminster, S.W., licensees of Messrs. J. & A. Niclausse, of Paris, and representatives for the British Empire of the "Niclausse" water-tube boilers, superheaters, economisers and automatic mechanical stokers, have sent us their catalogue No. 2, dealing with automatic stokers. Over 150,000 h.p. of "Niclausse" boilers have been fitted with these automatic stokers. The special advantages of the Niclausse automatic stoker are as follows:—It is not a chain grate, and thus there are no links liable to be broken. The fire bars are in short lengths, any of which can be replaced when worn out. The motion given to the fire-bars is in accordance with the best requirements for complete combustion of the fuel, and the combustion takes place at a point where the gases produce the greatest heat. The motion can be varied to suit various classes of fuel. The draught is regulated proportionately to the combustion at different parts of the grate. The grate is entirely independent of the rest of the boiler, and can be removed bodily in a few minutes, leaving a large space in the boiler for inspection, thus giving perfect access to the boiler and to the grate. It can be adapted to and installed in any class of boiler with the greatest facility. Low price—strong construction—few repairs. Small upkeep expenses. Minimum amount of labour, and combustion independent of skill of firemen. No smoke—perfect combustion—no waste.

THE ELECTRIC & ORDNANCE ACCESSORIES CO., LTD., are now being represented in Ireland for their electrical manufactures by The Hurst Electric Manufacturing Co., Belfast.

CORONATION EXHIBITION.—This exhibition, recently opened, promises to be a very good one. The Press Section comprises exhibits by most of the well-known papers and is very interesting.

NEW PORT WORKS AT BUENOS AIRES.—Messrs. C. H. Walker & Co., Ltd., the well-known contractors of St. George Street, London, S.W., some time ago placed a scheme before the Argentine Government for proposed port extensions at Buenos Aires. This scheme has just been accepted.

OUR VOLUME XXXIII. will be concluded with the July issue. August, 1911, will commence the XXXIV. annual volume of *The Marine Engineer and Naval Architect*, and affords intending subscribers a fitting opportunity to send in their subscriptions to commence the new volume. Subscription rates, 7/6 per annum, post-free to all parts of the world.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES—English.

Steel Screw Drifters.—On April 1st, there was launched from the yard of Messrs. Cochrane & Sons, of Selby, three steel screw drifters, built to the order of Lowestoft owners. The vessels will be replete with all the latest improvements for the drift fishing trade, and two of them will be fitted with powerful triple expansion engines, and the third with compound surface condensing engines, all by Messrs. Crabtree & Co., Ltd., of Yarmouth.

Vonolel.—On April 3rd, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, a handsomely modelled steel screw trawler, the principal dimensions being 130 ft. by 22 ft. 6 in. by 12 ft. 9in. moulded. The vessel has been built to the order of Messrs. The Atlas Steam Fishing Co., Ltd., of Grimsby, and will be fitted with powerful triple expansion engines by Messrs. C. D. Holmes & Co., Ltd., of Hull, and is replete with all the latest improvements for fishing purposes.

Yoro.—On April 3rd, the fruit steamer *Yoro* was launched on the Tyne by Messrs. Swan, Hunter & Wigham Richardson, Ltd. She is a finely modelled screw steamer, 270 ft. in length, built for the Emerald Steamship Co., Ltd., and specially arranged for fruit carrying between Gulf of Mexico ports. Great care has been exercised in the design of the vessel, so that the fruit may be carried under the best conditions, and for this purpose efficient ventilation has been fitted. The vessel is built to Lloyd's highest class, and has accommodation for first-class passengers arranged amidships, consisting of cabines de luxe, together with state-rooms for 30 passengers. There is a handsome dining saloon. The *Yoro* carries an installation of wireless telegraphy. Powerful triple expansion engines are to be fitted, which, with their boilers, are also being constructed by the builders, and will drive the vessel at a high rate of speed.

Etolia.—On April 11th, there was launched from the yard of the Tyne Iron Shipbuilding Co., Ltd., Willington Quay-on-Tyne, a steel screw steamer, built to the order of the International Line Steamship Co., Ltd., of Whitby. As showing the increasing popularity of the new system of longitudinal framing, it is interesting to note that this is the third vessel built on the "Isherwood" system by these builders, who were the first to build this type of boat on the Tyne. The vessel is built to the highest class at Lloyd's, and is of the following dimensions, *viz.*: Length overall about 360 ft., breadth extreme 50 ft., depth moulded 25 ft. 10 in. She is built under the single deck rule, with poop, bridge, and forecastle. Has water ballast fitted right fore and aft on the cellular system, and is also fitted with all modern improvements for the rapid loading and discharging of cargo, including eight double cylindered steam winches, direct acting steam windlass, large multi tubular donkey boiler, steam steering gear, by Messrs. Donkin & Co., with right and left hand screw gear aft. She is fitted with double derricks to all main cargo holds, and has derrick posts on bridge for dealing with the cross bunker hatch, and is in all respects an exceptionally good example of the modern cargo steamer, as she carried about 6,400 tons deadweight on the very light draft of 21½ feet. The engines, which are to be supplied by Messrs. John Dickinson & Sons, Ltd., of Sunderland, are of the triple expansion type, having cylinders 24, 40 and 66 by 45 in. stroke, with two boilers 16 ft. by 10 ft. 6 in. working at a pressure of 180 lbs. Messrs. Wailes, Dove & Co.'s "Bitumastic" Enamel was applied to the bunkers, boiler room tank, engine room tank, and their "Bitumastic" Covering to the boiler room tank top.

Atlantica.—On April 12th, there was launched on the Tyne a steel screw steamer, ordered on behalf of the Atlantica Steam Navigation Company, of Budapest, by the Director-General, Mr. Pollacsek. The vessel is of the following dimensions: Length over all 390 ft., length between perpendiculars 378 ft., breadth extreme 52 ft. 3 in., and depth moulded 26 ft. 4 in. She is capable of carrying about 7,200 tons deadweight on a moderate draught of water. Triple expansion machinery will be fitted, the cylinders being 26, 42 and 68 in. in diameter, by 48 in. stroke, and there will be two single-ended boilers 17 ft. 6 in.

in diameter by 11 ft. 6 in. long, working at 180 lbs pressure.

Gabrielle.—On April 12th, Messrs. Osbourne, Graham & Co. launched from their yard at Hylton the steel screw steamer *Gabrielle,* which is the second vessel they have specially constructed to the order of Fernand Bouet, Esq., of Caen. The vessel is a single decker, 259 ft. by 35 ft., built to carry 2,100 tons on a very shallow draft, and is of the self-trimming collier type. The steamer is fitted with the most modern appliances for economical and quick working of the cargo. She has been constructed to Lloyd's highest class, and also complies with the requirements of the French law. After the launch the vessel proceeded to the works of the N.E. Marine Engineering Co., Ltd., of Sunderland, for her machinery, which has been designed to drive the vessel a speed of 10 knots loaded.

Birchfield.—On April 12th, this large and finely modelled vessel was successfully launched from the North Sands Shipbuilding Yard of Messrs. Joseph L. Thompson & Sons, Sunderland, and is the tenth vessel launched from this yard for the same owners, Messrs. Joseph Brown & Son, of Liverpool, and the second of the same name for this firm. She is constructed on the Isherwood system of longitudinal framing, with absolutely clear holds, and large hatchways for the economical working of cargoes. A large quantity of water ballast is provided in the cellular double bottom and in the fore and after peaks. Large and powerful propelling machinery has been constructed by Messrs. John Dickinson & Sons, Ltd., of Sunderland, and a complete equipment of deck machinery and gear of the most up-to-date description will be fitted, and when completed the vessel will be a fine example of the modern cargo steamer.

Olympia.—On April 12th, there was launched from the yard of Messrs. Jos. T. Eltringham & Co., South Shields, a finely modelled steel screw tug and salvage steamer, which has been constructed to the order of Messrs. Amaral, Sutherland & Co., Ltd., of Cardiff and Rio Janeiro. The vessel has an over all length of 102 ft., and is to be fitted with compound engines and boiler of large power, also salvage and fire appliances. She has been constructed to Lloyd's 100 A1 class and special survey.

Boheme.—On April 13th, Messrs. Wm. Doxford & Sons, Ltd., launched from their yard at Pallion, Sunderland, a single deck vessel built to the order of Austrian owners. The dimensions are: Length 386 ft., breadth 50 ft., moulded depth 28¾ ft. Deadweight capacity 7,500 tons on a moderate draft. The engines and boilers are being constructed by Messrs. Doxford. The *Bohême* has been built to Lloyd's classification.

Andalusian.—On April 13th, Messrs. W. Harkess & Son, Ltd., launched from their yard at Middlesbrough, the handsome steel screw steamer *Andalusian,* which has been built to the order of Messrs. The Ellerman Lines, Ltd., and is specially designed for fulfilling the requirements of their Mediterranean and wine trades. Her principal dimensions are: 310 ft. long by 40 ft. 6 in. beam, and 25 ft. depth moulded. She is built to a very complete specification, to class 100 A1 at Lloyd's, with two decks laid, and will carry 4,500 tons deadweight on moderate draft. Machinery will be fitted on board by Messrs. Richardsons, Westgarth & Co., Ltd., of Middlesbrough, capable of driving her a speed of 11 knots loaded. The vessel and her machinery have been built under the superintendence of Mr. Alexander Dalrymple, of Liverpool.

Lydia.—This powerful steel screw salvage tug, built by Messrs. Hepple & Co., shipbuilders and engineers, of South Shields, for the Buenos Ayres Great Southern Railway Co., Ltd., for work in South America, to the designs of James Pollock, Sons & Co., Ltd., of London and Liverpool, has just been completed. Her dimensions are: Length 101 ft. by 21 ft. by 12 ft. 6 in., with a mean draft of 9 ft. 6 in. The tug is fitted with triple expansion, surface condensing engines, having cylinders 14 in., 22 in., and 36 in., with 24 in. stroke, and a marine return tube type boiler 14 ft. diameter, working at a pressure of 180 lbs. per square inch. The *Lydia* has been classed 100 A1 at Lloyd's, and built under their special survey. Watertight compartments to the number of five have been arranged. Pollock's patent stern frame has been fitted [illegible] The decks are all of teak, including the flying bridge and a large teak pilot house and chart room. Accommodation on an extensive scale has been arranged for the captain and officers on the starboard side of the vessel, and on the port side a comfortable dining saloon has been allowed for. The crew's accommodation is arranged aft of the machinery space. Electric light, powerful searchlight, steam steering gear and salvage and fire plant, steam winch and windlass, etc., are among the many features of this craft.

Grangemoor.—On April 26th, a steamer named *Grangemoor* was launched at Sunderland. The vessel, which is owned by Messrs. Walter Runciman & Co. (Ltd.), is intended for the general cargo trade, and carries 5,500 tons. She was named by Mrs. Sellors, niece of Sir Walter Runciman. In the course of a brief speech, Sir Walter Runciman said the new vessel did not belong to the Moor Line. She was bought mainly for himself and family and a few personal friends who desired to have an interest in the "sixty-fourther." That was the reason why they bought the vessel during construction.

San Andres.—On April 27th, Messrs. Wood, Skinner & Co., Ltd., successfully launched from their shipbuilding yard at Bill Quay, Newcastle-on-Tyne, a new steel screw fruit steamer, which has been built by them to the order of Mr. Otto Thoresen, of Christiania, for the Otto Thoresen Linie. The vessel has two complete steel decks, the upper deck being sheathed. Ample water ballast is provided in cellular double bottom all fore and aft and in after peak tank. The saloon, passengers' berths, etc., are in a large steel deckhouse amidships, with captain's room and chartroom in house above, the officers and engineers being berthed in sidehouses on each side of engine casing and the crew aft. The vessel will be specially fitted with the most modern arrangements for fruit carrying, including complete system of ventilation, as well as appliances for facilitating the rapid loading and discharging of cargo. The propelling machinery will be of the improved triple expansion type, having cylinders 22 in., 36 in. and 60 in. diameter by 39 in. stroke, supplied with steam by three large steel multitubular boilers working at a high pressure under Howden's forced draught arrangement capable of propelling the vessel at a speed of twelve knots loaded. Both the ship and the engines have been constructed to the requirements and under the special survey of Det Norske Veritas for their highest classification and to the specification and supervision of Mr. Carl Conradi, of Christiania. This is the eighth vessel which the builders have constructed for the same owner, and they have also a sister vessel to the above now building on the stocks.

Blackheath.—On April 28th, Messrs. Ropner & Sons, Ltd., Stockton-on-Tees, launched from their shipbuilding yard, a steel screw steamer of the following dimensions, *viz.*: Length, 403 ft.; breadth, 32 ft.; depth, 30 ft. 3 in. The vessel will be classed 100A1 at Lloyd's, having main deck, poop, bridge and T.G. forecastle. Accommodation for captain, officers and engineers in houses on bridge deck, crew in forecastle and poop. The vessel has been built to the order of Messrs. Watts, Watts & Co., Ltd., London, under the supervision of Mr. W. V. Lang, of London. She will be fitted with double bottom for water ballast on the cellular principle, all fore and aft, and in fore and after peaks, and fully equipped with an up-to-date outfit including quick warping steam windlass, stockless anchors, steam steering gear amidships, and powerful screw gear aft, independent winch condenser, electric light, &c., &c. The appliances for loading and discharging cargoes expeditiously are very complete, and include eleven steam winches, double derricks to each hatch, steam being supplied by a large donkey boiler working at 120 lbs. pressure per square inch. The engines will be of the triple expansion type, by Messrs. Blair & Co., Ltd., Stockton-on-Tees, of about 2,000 I.H.P., having two steel boilers 15 ft. 6 in. by 11 ft. 6 in., 180 lbs. steam pressure.

Oreland.—On April 28th, the Northumberland Shipbuilding Company, Ltd., launched from their yard at Howdon-on-Tyne, a finely moulded steamer built to the order of The Noreuro Traders' Limited (Fred Drughorn, Ltd., London Manager). The vessel is about 380 ft. long by 51 ft. beam by 28 ft. 9 in. deep, and has been built under special survey to the highest class at Lloyd's. She is fitted with long bridge, long poop, topgallant fore-

castle, the accommodation, which is very ample, being placed in steel houses on bridge deck. Special attention has been paid to the loading and discharging gear, and a complete outfit for the rapid handling of cargoes arranged for consisting of ten steam winches by Messrs. Clarke, Chapman & Co., Ltd., Gateshead-on-Tyne, a large number of cargo derricks, and steam windlass by Messrs. Clarke, Chapman & Co., Ltd. She is fitted with the usual water ballast arrangements for light passages. The machinery will be supplied by Messrs. Richardsons, Westgarth & Co., Ltd., Sunderland, consisting of engines with cylinders 25 in., 41 in. and 69 in. by 48 stroke, three boilers with 180 lbs. pressure. The vessel will carry about 7,500 tons on a light draught and steam about ten knots loaded at sea.

Tilemachos.—On April 28th, Messrs. William Gray & Co., Ltd., launched the handsome steel screw steamer *Tilemachos,* of 6,200 tons capacity, which they have built for Mr. George C. Dracoulis, Braila. She will take the highest class in Lloyd's Register, and is of the following dimensions, *viz.*: Length overall, 367 ft.; breadth, 50 ft. 8 in.; and depth, 24 ft. 3 in., with extra long bridge, poop and topgallant forecastle. The hull is built with deep frames, cellular double bottom and large aft and fore peak ballast tanks, six steam winches with return exhaust, steam steering gear amidships, hand screw gear aft, patent direct steam windlass, large horizontal multitubular donkey boiler, shifting boards throughout, stockless anchors, telescopic masts with fore and aft rig, boats on deck overhead and all requirements for a first-class cargo steamer. Triple expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 25 in., 40½ in., and 67 in. diameter, with a piston stroke of 45 in. and two large steel boilers for a working pressure of 180 lbs. per square inch.

Kinkasan Maru.—The development of the coal trade of Japan from the extensive Miiki collieries of the Mitsui Bussan Kaisha which have a large and increasing export trade to Hong Kong, Shanghai and the rivers of China (which has hitherto been carried on by chartered steamers) has now induced the Company to build their own steamers for the trade. They have given most careful and expert consideration to the best type of collier, and this has resulted in their selecting the Cantilever Framed Type with topside water ballast tanks as patented by Harroway & Dixon, and have placed orders for two steamers of 8,000 tons and two of 3,000 tons in this country, the first of which, named the *Kinkasan Maru,* built by Messrs. Sir Raylton Dixon & Co., Ltd., Middlesbrough—the owners of the patents—was launched from the Cleveland Dockyard on April 29th, 1911. The Mitsui Bussan Kaisha, under the chairmanship of the Baron Mitsui, is one of the largest commercial and mining firms of Japan, with offices in London, and they have placed the orders through Messrs. Glover Bros., of London. The steamer is of the single deck type with poop, bridge and forecastle. Her principal dimensions are 393 ft. 6 in. by 53 ft. 7 in. by 29 ft. 7½ in. moulded, with a deadweight carrying capacity of about 8,200 tons on a light draft of water. The principal feature of her design is that she is self-trimming with absolutely clear holds and six enormous hatchways of 33 ft. by 32 ft. There are large wing tanks at the top of the holds at each side supported on the Cantilever principle, and containing 1,350 tons of water ballast in addition to an equal quantity in the double bottom. The officers' and engineers' accommodation is provided in houses on deck. She will have 12 derricks worked by 11 steam winches, electric light throughout and for working cargo, and is in every respect the most up-to-date collier yet built. Engines having cylinders 26, 42, 70, by 48 stroke, with three large boilers, are to be fitted by Messrs. Blair & Co., Ltd., of Stockton-on-Tees.

Clan Macphee.—On April 29th, Messrs. Irvines Shipbuilding and Dry Docks Co., Ltd., launched from their Middleton Shipyard the handsomely modelled steel screw steamer *Clan Macphee,* for the Clan Line, Ltd., of Glasgow (Messrs. Cayzer Irvine & Co., managers), this being the largest of six vessels built for the same owners at the Middleton Shipyard. The dimensions of the vessel are 450 ft. by 53 ft. 6 in. by 37 ft. depth moulded to the shelter deck. The vessel has complete main, upper and shelter decks, and is classed to the highest class in the British Corporation Classification Society, having cellular double bottom all fore and aft for water ballast, and a large deep tank placed at the fore end of the boiler room. The vessel has seven watertight bulkheads, and is built with wide spaced tubular pillars and girders under the various decks, giving clear holds for the carrying of locomotives and other large pieces of machinery. The loading and discharging appliances have received special attention, the vessel having nine powerful steam winches, eleven derricks, including two for lifting weights of 15 tons, and one for dealing with 40 ton lifts. The vessel is fitted with the usual complement of lifeboats, and is fitted throughout with electric light, including signal lamps, binnacle lamps, cargo clusters at each hatch, etc. The steam steering gear is placed amidships, with Lyall's patent buffer gear fitted in connection with the hand gear aft. A quick warping steam windlass is fitted forward, steam being supplied to all the deck machinery and all auxiliaries from either of the three main boilers, and from a large multitubular donkey boiler. The propelling machinery, which is being supplied by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, consists of a powerful set of triple expansion engines, with three forced draught boilers working at a pressure of 200 lbs. per sq. inch. The cylinders are 29 in., 49 in. and 80 in. diameter by 60 in. stroke, and the machinery throughout has been designed for a high piston speed and for developing a large power under ordinary working conditions at sea. The propellor is arranged with loose blades of Manganese bronze, and it is expected that a speed of over 12 knots will be obtained with the ship fully loaded. The condenser is of the "Contraflo" type arranged with feed temperature regulation so that a high vacuum will be maintained in all temperatures of sea water. The air and circulating pumps are driven from the main engines in the usual manner, and in addition to the ordinary feed pumps a pair of independent float control pumps are installed working in connection with a feed heater of the direct contact type. To minimise "racing" in bad weather an Aspinall's Governor is fitted to the main engines and the cylinder casings are automatically drained by means of Geddes' Pulsator Water Traps. The engine room auxiliaries are very complete and include large ballast, feed and general purpose donkeys, also a Morison's Evaporator of the improved vertical radial type.

Tregurno.—On May 1st, there was launched from the Shipbuilding Yard of Messrs. John Readhead & Sons, Ltd., West Docks, South Shields, a steel screw steamer, built to the order of Messrs. Edward Hain & Son, St. Ives, Cornwall, and named the *Tregurno.* The vessel is of the improved single deck type to Lloyd's highest class, and under their special survey, having poop, extra long bridge and topgallant forecastle, with deep girder framing, and having cellular double bottom all fore and aft, with large after peak tank for water ballast. The outfit of the ship is very complete for general and grain trades with shifting boards all fore and aft, and trunk feeders as hatchways. A full equipmment of steam winches and derricks is fitted for rapid loading and discharging of cargoes. She will carry a deadweight cargo of 7,550 tons on a light draft of water. The vessel will be fitted with triple expansion engines, also constructed by Messrs. John Readhead & Sons, Ltd., having cylinders 26, 42 and 69 inches, and 48 inches stroke, supplied with steam from two large steel boilers working at a pressure of 160 lbs. per square inch. This is the fifty-fifth vessel built for the above firm by Messrs. John Readhead & Sons, Ltd.

LAUNCHES—Scotch.

Krian.—On April 27th, there was launched at Greenock the new passenger steamer *Krian,* which has been built to the order of the Straits Settlements Co., Singapore. The vessel has a gross tonnage of about 850 tons, the principal dimensions being 210 ft. by 35 ft. by 20½ ft. moulded to shelter deck. She has been designed for the coasting service in the Straits Settlements. Accommodation is provided for a number of first and second-class and native steerage passengers, while the main deck is fitted throughout with stalls for carrying cattle. The machinery con-

sists of a set of triple expansion engines. A Cochran (Annan) donkey boiler with patent seamless furnace has been supplied and fitted.

Sheng Ta.—On April 28th, there was launched from the yard of Messrs. Napier and Miller, Ltd., Old Kilpatrick, the steel screw steamer *Sheng Ta,* built to the order of the Imperial Railways of North China. The dimensions of the vessel are: Length, 265 ft.; breadth, 38 ft.; depth, 19 ft., with a gross tonnage of about 1,600 tons. Built under special survey to the rules of the British Corporation. The vessel is rigged as a two masted schooner, has accommodation for officers and engineers on bridge deck amidships, staterooms for a limited number of passengers, also accommodation for second-class Chinese passengers and coolies. The vessel which is built for trading on the China coast has been fitted with electric light, steam heating, steam steering gear, steam windlass and steam winches. The machinery is being supplied by Messrs. Dunsmuir & Jackson, Ltd., Govan, and consists of triple expansion engines with cylinders 19 in., 31 in., 51 in., with 36 in. stroke and two boilers of large size, 180 lbs. working pressure. Messrs. Matthew Keenan & Co., Ltd., secured the contract tor covering the boiler and pipes on board the vessel, which work has been completed.

City of Baroda.—On April 29th, there was launched at Whiteinch the steamer *City of Baroda,* built for the Ellerman Lines, Liverpool. The vessel, which is 412 ft. 9 in. in length, 50 ft. 9 in. in breadth, and 32 ft. 3 in. in depth, is built to Lloyd's highest class. She has two complete steel decks, with a steel poop, bridge, and forecastle. The cargo hold and 'tween decks are completely free from obstruction, large span girders and wide-spaced pillars being employed. There are seven large hatchways served by ten powerful winches, capable of dealing expeditiously with a large cargo. Additional stability and draught when in light trim is provided by a deep tank abaft the engine-room bulkhead. Telescopic masts are fitted in order to enable the vessel to pass under the Manchester Canal Bridges.

Saguenay.—On April 29th, the twin-screw steamer *Saguenay* was launched by the Fairfield Shipbuilding and Engineering Company, Govan. She is a vessel of a type not seen frequently on the Clyde. She is intended for the service of the Richelieu and Ontario Navigation Company between Montreal and Quebec or Quebec and Saguenay, and is 375 ft. in length, 54 ft. 6 in. in breadth, and 40 ft. in depth to hurricane deck. She has five decks, and has an imposing appearance. The vessel will have sleeping accommodation for 240 first-class passengers, and a crew of 76 men, but will be certified to carry 1,700 passengers. There are special observation turrets and cabins from which passengers can view the scenery through which they are passing, and the vessel will be fitted inside in a very attractive style. Triple expansion engines will be supplied by the builders. The naming ceremony was performed by Mrs. Strachan, of Corona, Dumbreck. The *Saguenay* is expected to sail for Canada early in June. Messrs. Matthew Keenan & Co., Ltd., secured the contract to cover the boiler and pipes on board the vessel, which work has been completed.

Dorothy Hough.—On April 29th, the steamer *Dorothy Hough,* which has been built for Messrs. Samuel Hough, Ltd., Liverpool, was launched at Grangemouth. The vessel, which is 295 ft. in length, 36 ft. in breadth, and 20 ft. 6 in. in depth moulded, is of the single deck type, with combined poop and bridge, and has accommodation for 100 first-class passengers. She is intended for cargo and passenger trade between Liverpool and London, and will be fitted with machinery designed to give a speed of about 12 knots. Messrs. Matthew Keenan & Co., Ltd., have secured the contract to cover the boiler and pipes.

Lord Lonsdale.—On May 4th, the s.s. *Lord Lonsdale* was launched from the yard of Messrs. William Hamilton & Co., Port Glasgow, to the order of Messrs. John Herron & Co., of Liverpool. The vessel, together with her machinery, has been built under the superintendence of Messrs. Flannery, Baggallay & Johnson, Ltd., of London, Liverpool, and Rotterdam. The vessel, which has been built on the Isherwood system, is designed to carry a large cargo on a light draught, and her principal dimensions are: 380 ft. B.P.; 51 ft. breadth; and 29 ft. 4 in. moulded depth. She is classed 100 A1 at Lloyd's, and has a poop and forecastle. Officers' and engineers' accommodation is arranged in houses on the bridge deck, and on top of this is fitted the captain's cabin and above this a flying bridge. The crew's accommodation is arranged under forecastle. The vessel is fitted with cellular water ballast tanks. There are eight powerful winches driven by a large donkey boiler, and vessel is equipped with up-to-date appliances for the rapid handling of cargo. The engines have been built by Messrs. David Rowan & Co., of Glasgow, and are of the triple expansion type, and have cylinders 26 in., 42 in., and 70 in., with a stroke of 48 in., which are to drive the vessel at a speed of about 11 knots per hour, with three large boilers with a working pressure of 180 lbs. per square inch.

Ellora.—Messrs. Alex Stephen & Sons, Ltd., Linthouse, launched the steamer *Ellora,* sister ship to the s.s. *Ellenga,* recently built by them for the Indian Coastal Service of the British India Steam Navigation Co., Ltd. The *Ellora* is 410 ft. in length between perpendiculars, 52 ft. in breadth, and 35 ft. in depth. She has three complete decks, with bridge and boat decks above, and has accommodation for 50 first-class and 50 second-class, both classes being equally well fitted up. Special provision has also been made for native passengers, two complete decks being reserved for their use. The propelling machinery consists of two sets of triple expansion engines, with two double-ended and two single-ended boilers, constructed by the builders.

Saint Leonards.—On May 11th, Messrs. Archd. McMillan & Son, Ltd., Dumbarton, launched the steel screw steamer *Saint Leonards,* which they have built to the order of Messrs. Rankin, Gilmour & Co., Ltd., Liverpool. The vessel, which is the fourth Messrs. McMillan have built for this firm, is of the following dimensions, *viz.*: Length B.P., 384 ft.; breadth, 50 ft.; depth, 29 ft. 9 in., and is fitted out in the most up-to-date manner with all the latest arrangements for working cargo. Very complete accommodation is provided on top of bridge for captain, officers, and engineers, while the crew are berthed forward. The machinery, which is of large power, is being supplied by Messrs. Rankin & Blackmore, Greenock, and both vessel and machinery have been built under the special survey of Lloyd's for their highest class. During construction the steamer has been under the supervision of Mr. Reid, Captain Pugh, and Mr. Forrest, the owners' representatives.

Bolinder.—The *Bolinder,* a new motor fishing vessel, was recently launched at Eyemouth, when a large crowd of onlookers, including most of the fishermen of the port, in addition to large numbers from the neighbouring towns, came out specially to witness the ceremony. The launching was a complete success, the vessel leaving the weighs in graceful style and without the slightest hitch. The dimensions of the *Bolinder* are: Length, 82 ft. 9 in.; breadth, 18 ft. 3 in.; depth, 9 ft. 9in., and she has been fitted with a 120 B.H.P. double cylinder Bolinders direct reversible crude oil marine engine, capable of developing a brake horse power of 150. This motor will run on Scotch Shale Oil Fuel, and will cost approximately 3/- to 3/3 per run, and it will not be very long before the fishermen, especially on the East Coast, will fully appreciate the low cost of running a motor, over that of the steam engine. Accommodation has been arranged for aft, for eight crew and forecastle for four, and the reason that such a large accommodation has been allowed for, without in any way diminishing the fish hold space is that the crude oil engine takes up such very little room in comparison with a steam engine. This vessel has been built with a view for sale, but unless sold before the herring season starts, she will be fishing under the direct control of Messrs. Pollocks and Mr. J. Weatherhead.

Lady Gwendolen.—On May 13th, the Clyde Shipbuilding & Engineering Co., Ltd., Port Glasgow, launched for the British and Irish Steam Packet Co., Ltd., of Dublin, a steel screw passenger steamer for the Channel trade between Dublin and London and South of England ports. The vessel is 300 ft. by 39 ft. 6 in. by 18 ft. 9½ in., and has been constructed to Lloyd's highest class, and to Board of Trade survey, under the superintendence of Mr. J. A. Patterson, of Dublin, the Company's marine superintendent. Vessel was named *Lady Gwendolen* by Miss Gretta Moir, and immediately after the launch, was placed in

the company's dock to receive her machinery, which has also been constructed by the builders. Messrs. Wailes, Dove & Co.'s "Bitumastic" Enamel was applied to bunkers, boiler room, holds, tanks, etc. Messrs. Matthew Keenan & Co., Ltd., have secured the contract to cover the boiler and pipes.

Ustica.—A passenger and cargo steamer of about 410 tons gross has been launched at Govan for La Societa Anonima di Navigazione La Sicana, Trapani, Sicily. The vessel, which was named *Ustica,* is fitted with accommodation for a number of first and second-class passengers, and is intended to trade amongst the islands between Trapani on the west of Sicily and the mainland of Italy. Triple expansion engines of 600 indicated horse power will be supplied. The estimated speed of the vessel is 11¼ knots. A Cochran (Annan) donkey boiler with patent seamless furnace has been supplied and fitted.

Labrus.—On May 16th, Messrs. Wm. Simons & Co., Ltd., of Renfrew, the well-known dredge builders, launched one of their "Simons" Patent Cutter Suction Hopper Dredgers, named the *Labrus,* to the order of the Government of the Union of South Africa. The bottom of Durban Bay, where the dredger is to be employed, is composed almost wholly of clay of a very hard nature. The dredging of this character of material by means of a spiral rotary cutter is only a recent development in dredge building. The first hopper dredger of this type being the "Simons" dredger *St. Lawrence,* constructed last year to the order of the British Admiralty. The *Labrus* is a twin screw hopper vessel of 2,000 tons carrying capacity, and is fitted with an independent set of triple expansion engines for driving the dredging pump, with a complete installation of auxiliary machinery, in a separate engine room immediately in front of the hopper compartment. Steam for the propelling and pumping engines and all machinery throughout the dredger is supplied by three large marine type steel boilers. The dredging pump is of the most massive and powerful description to withstand the shocks which may be sustained when dredging in clay mixed with stones. The suction pipe is carried on a girder led through a well forward, and is of sufficient length to enable dredging to be done at a depth of 45 feet below water line. The dredger has also been designed for cutting its own flotation. The cutter at the mouth of suction pipe is driven through a line of shafting, fitted on upper side of suction frame, and machine-cut steel gearing actuated by a set of powerful independent compound condensing engines. In addition to the usual winches for mooring from the deck at bow and stern a special winch is placed amidship from which the moorings are led along the suction frame to fairleads at lower end. The hopper is fitted with "Simons" patent arrangements whereby the contents of the hopper can be dscharged either through the doors in the ordinary way, or overside by the pump for land reclamation. In addition to loading into its own hopper, the vessel is arranged to discharge into barges moored alongside, or through a pipe line. Two sets of triple expansion surface condensing engines are fitted aft for propelling the vessel at a speed of 10 knots per hour. The auxiliary machinery in the propelling engine room is of the most up-to-date character. The dredger has been built under special survey by Lloyd's, and to their full requirements. The *Labrus* is the nineteenth dredging vessel constructed by Messrs. Simons & Co., Ltd., for Durban.

LAUNCHES—Irish.

Nomadic and Traffic.—The twin screw passenger tender *Nomadic* was launched by Harland & Wolff, Ltd., Belfast, on April 25th, and the twin screw baggage tender *Traffic* on April 27th. The *Nomadic* is 220 ft. long by 37 ft. beam, and will have accommodation for about 1,000 passengers. The *Traffic* is 175 ft. long by 35 ft. beam. Both these vessels have been specially designed for service at Cherbourg, and will be completed in time to attend the *Olympic* during her steam trials before departure from Belfast. The *Traffic* will be fitted with electric baggage conveyors, one at the fore end and one at the after end of the bridge deck, for conveying baggage to and from the upper deck. She will also have accommodation for transporting a large number of passengers, and both vessels will have a complete installation of electric light.

La Senora.—On May 17th, shortly before high water, Messrs. Workman, Clark & Co., Ltd., Belfast, launched from their South Yard a large handsomely modelled steamer built to the order of the Tropical Fruit Steamship Co., Ltd. (Messrs. Clark & Service, managers), Glasgow. The vessel has been named *La Senora,* and has been specially designed for the general fruit and refrigerated freight trades between the West Indian and United States ports, having also commodious and comfortable accommodation for a large number of passengers. This accommodation has been carefully designed to afford the utmost comfort to passengers, the public and private rooms being decorated and furnished in the most artistic and luxurious manner. The vessel is 394 ft. in length, with a gross tonnage of over 5,000. The cargo space is divided into eight compartments, and has been insulated throughout and otherwise prepared for the carriage of fruit cargoes in bulk. The cargo will be preserved in good condition during transit by cooled fresh air delivered through ducts to each compartment by electrically driven fans. The propelling machinery consists of a set of improved triple expansion engines, complete with all the necessary auxiliaries and having steam from five single-ended boilers working under forced draught. The construction of the vessel has been carried out under special survey for the highest class in the British Corporation Registry of Shipping, while the requirements of the British Board of Trade and the United States Steamship Passenger Inspection Service have also been fully complied with.

TRIAL TRIPS.

Zeitieh.—Trials were run on the Clyde lately by the new steamer *Zeitieh* engined by James Ritchie, Glenavon Works, Partick. The vessel has been built for the Egyptian oil trade, under the superintendence of Messrs. W. C. Carter & Catto, of London, and is fitted with the latest type of oil fuel burning apparatus. The trials were thoroughly successful in every way, the machinery running smoothly throughout, and the guaranteed speed being easily exceeded.

Trevorian.—On April 24th, the new screw steamer *Trevorian,* built by Messrs. John Readhead & Sons, Ltd., West Docks, South Shields, to the order of Messrs. Edward Hain & Son, St. Ives, Cornwall, was taken to sea on her official trial trip. After the trial, which was in every way satisfactory to all concerned, the vessel proceeded to Tyne Dock to load for Civita Vecchia, under the command of Captain Gorley. See Launches, April.

Halvdan.—On April 25th, the fine steel screw steamer *Halvdan,* built by Sir Raylton Dixon & Co., Ltd., at their Cleveland Dockyard, Middlesbrough, to the order of Messrs. Bruusgaard, Kiosterud & Co., of Drammen, Norway, proceeded to sea for her official trials. The trials passed off most successfully, and the vessel, under the command of Captain T. K. Simonsen, proceeded direct to the Tyne. See Launches, April.

Themis.—On April 25th, the large single-deck vessel *Themis,* the second vessel of the same size, built and engined by Messrs. Wm. Doxford & Sons, Ltd., Sunderland, to the order of Wilh. Wilhelmsen, Esq., Tonsberg, ran a successful sea trial, when a speed of 11.8 knots was obtained. See Launches, May.

Moacyr.—On April 26th, the steel twin-screw steamer *Moacyr,* recently launched on the Clyde for service on the Amazon, ran an official trial trip under fully loaded conditions. The weather was rather unfavourable, but the vessel carried through all the conditions of the contract, the machinery throughout the trial running without a hitch. See Launches, May.

Caresfield.—On April 29th, the s.s. *Garesfield,* the finely modelled self-trimming collier, built by Messrs. Robert Thompson & Sons, Ltd., at their Southwick Yard, to the order of Messrs. The Gordon Steam Shipping Co., Ltd., of London, was taken out to sea for her official trial. See Launches, May.

Lissa.—On May 1st, the s.s. *Lissa,* lately launched by Messrs. Short Brothers, Ltd., of Sunderland, to the order of Messrs. Glen & Co., for the Scandinavian Shipping Co., Ltd., of Glasgow, left the Wear for her official trial. The trial was in every way a success, a speed of 12 knots being easily maintained. See Launches, May.

Zevenbergen.—On May 4th, the s.s. *Zevenbergen* proceeded on her official trial trip in Hartlepool Bay. After adjusting compasses a trial spin was made, a speed of 11 knots being obtained, the vessel then proceeding to Cardiff to load. See Launches, May.

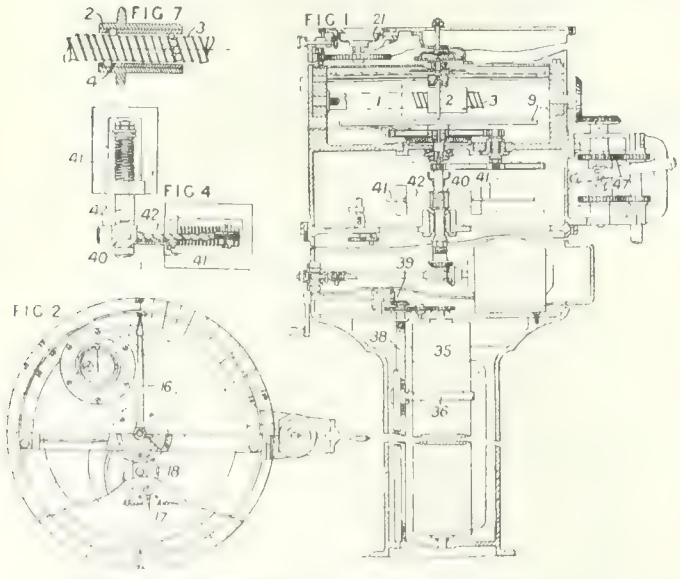
The City of Lahore, which has just been completed by Messrs. Swan, Hunter, and Wigham Richardson (Ltd.), Wallsend-on-Tyne, is a handsome addition to the City Line, controlled by Sir John Ellerman. This steamer is intended for service between Glasgow and Liverpool and Calcutta. A most successful trial trip at sea was completed recently. Throughout the trial the engines and boilers, which have been constructed by the Wallsend Slipway and Engineering Company, Ltd., worked without any hitch whatever, and a mean speed of 13½ knots an hour was maintained. *The City of Lahore* is 450 ft. long; 54 ft. broad, with a moulded depth of 33 ft. 10 in.; the deadweight capacity being 10,000 tons. On the boat and bridge decks there is very comfortable accommodation for 70 first-class passengers, and in addition to these there are cabins for 40 second-class passengers in the poop. Electric light is installed throughout the ship.

Steel Screw Steamer.—On May 13th, the Blyth Shipbuilding and Dry Docks Co., Ltd., launched from their Shipbuilding and Graving Dock Works a fine steel screw steamer built to the order of Messrs. The Northern Commercial Syndicate, Ltd., of Newcastle-on-Tyne. This vessel, which measures 366 ft. in length, with a beam of 50 ft. 10 in., has been constructed under special survey to Lloyd's highest class. She is of the single deck type, having poop, bridge, and topgallant forecastle. The accommodation for the captain is in a steel deck house, and for the officers and engineers in sidehouses on the bridge, whilst crew will be berthed in topgallant forecastle. The vessel is specially adapted for the general cargo and wood trade, having large hatches and clear holds together with the best and latest design of deck machinery, including eight cargo winches for the quick and economical working of the cargo. Triple expansion engines of good power will be supplied by Messrs. The North-Eastern Marine Engineering Co., Ltd., of Wallsend.

The Marine Engineer and Naval Architect Patent Record.

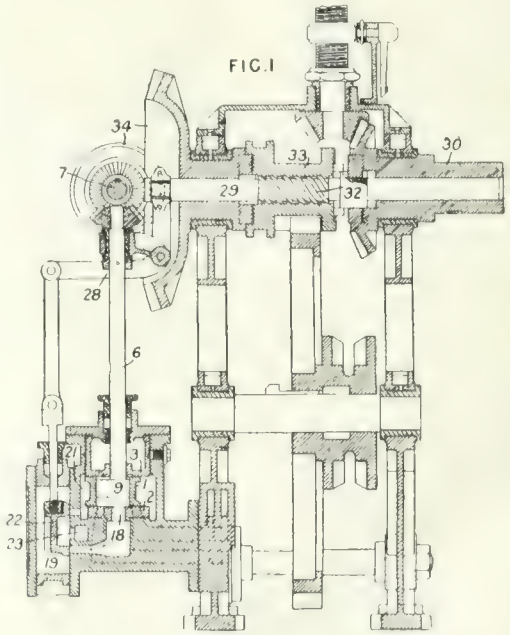
Compiled by Messrs. E. P. Alexander & Son, Chartered Patent Agents, 306, High Holborn, London, W.C.

No. 1591. Speed and Revolution-direction Indicators. The apparatus described in Specification 18,



[illegible] provided with the following additions and [illegible]. The thread of the nut of the screw-and-nut mechanism 2, 3, Figs. 1 and 7, is formed by a helical series of balls mounted in an inner sleeve 4 of the nut carrying the friction-wheel 2. A similar construction is shown in Fig. 4. (2) The driving disk 9 is rotated by an electric motor, controlled by a variable resistance 35, 36 operated by gearing 38, 39, instead of being directly driven by clockwork. A fan governor or fly 40, 41, 42, Fig. 4, is provided to keep the speed of rotation constant, the outward movement of the vanes 41 under increasing speed causing a corresponding rotation of the vanes upon their axes so as to increase their effective area. A casing 21 for a watch is driven from the motor through gearing; and the speed of the motor is arranged so that the centre second-hand of the watch remains stationary relatively to a fixed pointer. (3) An additional friction disk 18, Fig. 2, engages the friction-wheel 2 as this approaches its mean normal position over the centre of the driving disk 9, and by its friction ensures that the wheel 2 shall move away from the normal position upon the rotation of the screwed shaft 1, even when the face of the disk 9 is worn hollow at its centre. The disk 18 actuates, through gearing, a separate revolution-direction pointer 17. (4) A two-speed gearing 47 is provided so that, at cruising or normal speeds, the whole of the dial can be utilized by the pointer 16, which is then read in conjunction with a more extended scale.

No. 1680. Steering-engines. In a steering-engine of the type described in Specification 21,694/06, steam is distributed to the two cylinders by a single rotating cylindrical valve 1 in combination with the hand-operated controlling-valve 22, which connects the valve chamber 21 and the central passage 18 with the steam space 19 or the exhaust passage 23. The four steam passages from the two cylinders open in the valve seating 2, and are con-



nected with steam and exhaust by the valve 1, which has an eccentric motion under the influence of an eccentric 9 on a spindle 6 driven from the crank-shaft 7 through bevel-gearing. The valve 22 is operated through a bell-crank 28 from a spindle 29, on which there is a thread 32 engaging a pinion 33 driven by the hub of a bevel-wheel 34, which is driven from the crank-shaft. The sleeve 30, rotated by the hand steering-wheel, engages the spindle 29 by a key and drives it forwards or backwards, the spindle being returned by the rotation of the pinion 33. The valve 1 works between the seating 2 and an adjustable cylinder 3, which is screwed into the end of the valve casing and is secured by a lock-nut or set-screw

The Marine Engineer

And Naval Architect.

LONDON, JULY, 1911.

THE DECLARATION OF LONDON

IT will be remembered that in January last, the Government delayed proceeding with the Naval Prize Bill until after the meeting of the Imperial Conference, particularly, no doubt, owing to the evidence of adverse feeling as to the confirmation of the Declaration of London by some of the Colonies. The Conference has now met and discussed the question, and has resolved, on the motion of Sir Joseph Ward, Prime Minister of New Zealand, "That the Conference, after full consideration and debate, approves the ratification of the Declaration of London." It is interesting to note that the Australian delegates did not vote, and that Mr. Fisher, as representing the Commonwealth Government, said that the Declaration was such a great step forward that it would be wrong to abandon it, and although his Government could not give their full approval to it, he had determined not to oppose the resolution. It would appear that the general view of our Colonial brethren is, that the position as to food stuffs was strengthened and better protection was secured under the Declaration than under present conditions. A further point of advantage claimed is that the suggested Prize Court is infinitely better than one under existing arrangements, which is set up in the country called upon to pay for losses sustained. The suggested court is an international one composed so that in all probability a certain majority of neutrals would be present, which will be more advantageous than to trust to an enemy to settle the matter, with no opportunity of appeal from the decision given. It cannot be said that the support of the Colonials is in any sense whole-hearted, and the situation created is an interesting and important one. Since the matter was first brought forward, the business men of this country, in a very large majority, have given expression to their views that the Declaration would have a distinctly unfavourable effect upon the country as a whole, in time of war. The Association of Chambers of Commerce of the United Kingdom, has clearly and definitely condemned the Declaration on the grounds that food supplies for the peaceful population in neutral ships could be condemned; that sanction is given for the destruction of neutral prizes at sea; and that the onus of proof as to destination is taken from the captor and put on the owner of the captured property; and that the conversion of merchantmen into men-of-war on the high seas is not forbidden. So much for the opinion of commercial men of this country, who are usually capable of carefully weighing up the *pro* and *cons* of any question in which their interests are affected, and coming to an opinion, which in the main, it must be admitted is invariably sound and practical. We come now to a most strenuous opposition from another quarter altogether, *viz.*: a large number of Admirals of the Royal Navy, and at the moment of writing a private meeting of Admirals is taking place to consider the critical situation created by the Imperial Conference. We understand that 102 Admirals have sent a strongly worded protest to the Prime Minister, to the effect that it is urgently necessary for the preservation of the food of this country during war, that the Declaration of London should be repudiated. The meeting of the Admirals is being presided over by Lord Charles Beresford, whose personal conviction as to the serious situation created by the Declaration, may be summed up in the following: (1) The danger staring this country in the face if the Declaration is ratified, is not invasion but starvation; (2) under the Declaration, belligerents are, for the first time, legally permitted to sink neutral ships, and (3) under the Declaration, the transformation upon the high seas of merchantmen into warships is not forbidden, and it is, therefore, not illegal, and privateering is revived in its most dangerous form. The general view of the Admirals in question on the matter, would appear to be to refer the subject to a commission of experts for consideration, and report. Looking at it from the legal aspect, it is interesting to peruse a paper read at the British Academy by Professor Holland, K.C., in which he points out that the question is, whether, within the four corners of the Declaration, a code of prize law exists, such as if loyally followed by the suggested Court, would make its decisions unimpeachable by the signatories, and reasonably, in accordance with British interests, having special regard to our national safety. He also draws attention to important omissions from the document, and criticises the provisions as to blockade and contraband. In the discussion that ensued, the views expressed by the Lord Chief Justice of England are well worthy of the fullest consideration. He pointed out that it was argued by some people that the Declaration contained one or two things of such value to this country, that, in consideration therefore, sacrifices might be made on the two important questions of blockade and contraband. This view, however, did not seem to him the kind of way to deal with the question, as they ought not to give away important points in exchange for concessions in another direction. It had been stated that the convention might be considered to be modified and controlled by the explanatory report, but he would not be justified in advising his country, that it might, upon some satisfactory explanation in the report being used as construing the Declaration, and further, that the report and the Declaration were not altogether

consistent with one another. Having regard to the diversity of opinion that at present exists, and in view of the half-hearted support given by the Colonials, there surely is no possible reason why time should not be given to enable further discussion and investigation to take place, particularly as no good purpose will be served in pressing the matter to a conclusion immediately after the Coronation, as appears to be the present intention of the Government. If the Declaration is as good as it is claimed, let us have time to thoroughly appreciate its merits, and opposition will then die away.

Since writing the above we have ascertained that the meeting of Admirals referred to have passed a resolution calling on the Government to refer the subject to a Select Committee or a Royal Commission, but we must "wait and see" the result of this recommendation.

SOUTHAMPTON AND THE WHITE STAR LINE

TO those who were privileged to be present practically in one week at the launching of the *Titanic* and the simultaneous viewing of the *Olympic* at Southampton and the opening of the Docks which the London and South Western Railway Company have built for accommodating these boats, the singular importance of these three events both to the public in general and to Southampton in particular must have made a deep impression. We listened with the deepest satisfaction to the terms in which the Mayor of Southampton welcomed the *Olympic* to the port, recognising fully that the real interests of the borough, the harbour authority, the Railway Company and the steamship owners were of a common order and make for the one end, the prosperity of each, assuming that proper and efficient co-ordination of effort and interest exists. We have in the past dealt fully with the question of the administrative policy of the Southampton Harbour Board being conducted upon broad and comprehensive lines and we sincerely hope that the views of the Mayor as expressed reflect those of his fellow members on the Town Council and the Harbour Board over both of which he presides. We would repeat that it seems to us to be a suicidal policy to cater for a particular class of trade by spending large sums of money and when such trade comes along to penalise such trade by the imposition of a special tariff. There are in this instance three separate entities each spending its own money for the purpose of making a commercial profit, and so long as the relative conditions are such that each gets a fair return for the money there is nothing to complain of, but immediately one of the three is undesirably burdened so that the return is diminished or negatived altogether, the resultant effect is not on this entity alone but must in time spread to the other two, so that it is quite conceivable that the failure of one necessarily involves the failure of the three as far as profitable return is concerned. Any breakdown in the active co-operation of the three interests referred to, does not end with those who are directly interested as shareholders either in a public or private character, but must extend to every person in the district concerned and we could conceive no greater misfortune to Southampton than the existence of such a condition of things, which would prevent the magnificent accommodation now provided, being utilised to the fullest possible extent under conditions allowing a reasonable return to all who have sunk their capital for their own benefit and for the advantage of the community. It is, therefore, to be sincerely hoped that much of the bitterness of feeling that has been unnecessarily exhibited during the promotion of the Harbour Board's Bill will be wiped out by the better relations which the Mayor's speech clearly led one to think now existed. We are satisfied that if the people of Southampton, the Harbour Board, the Railway Company and the White Star organization pull together, Southampton will be placed in such a position as a port as would never have been dreamt of 20 years ago.

SEAMEN AND FIREMEN.

THE trouble which was briefly referred to in our last issue in connection with the seamen and firemen, has been accentuated during the month, and has led to some inconvenience in several British and Continental ports. The claims made by the promoters of the strike seem to fall far short of the actual conditions so far as their representative character is concerned, otherwise a better understanding would probably have prevailed and less barbarous methods have brought about results in keeping with the joint interests of all concerned. It is unfortunate that the old highwayman's "stand and deliver" attitude is resorted to in these days, when we consider the amount of enlightenment and wisdom accumulated from past ages for the benefit of the present generation, and one cannot but deplore the wayward measures which still prevail over those of a more enlightened character. Coming at such a time the trouble is aggravated when the national desire has been in the direction of loyalty and devotion to the national well-being. Concessions have been made under compelling circumstances by some companies to enable them to carry out their contracts, while many have been able to arrange otherwise without altering their plans. The concessions made are admitted to be of a temporary character and depend upon future arrangements; while those who have not made the concessions will be in a good position to consider what these arrangements should be to meet all cases. It would appear that too little attention has been paid to the receiving and training of young men for service, both on deck and in the engine room. This has led to abuses, as well as to the want of a good

choice of men, in view of the administration of the Workmen's Compensation Act, and its effect upon the labour market. There is no doubt that a large proportion of our firemen are good, as well as amenable to reason and discipline; it may be also added that they are in the main loyal to the companies they serve, but when they are incited to yield themselves to a contrary spirit from a feeling of comradeship, or in some cases by other means, along with a prospect of better pay, they may be, and in some cases have been swayed from their allegiance. Had the subject been carefully considered some months ago and a course of action resolved upon, the present situation would have been avoided. Voluntary concessions, even of a comparatively minor character, give pleasure both to the giver and the receiver, while concessions of great importance, which are bought at the point of the bayonet, give bitterness and breed discontent.

With a wise and capable representative in whom they could place confidence, to advise and guide them, the whole subject of accommodation, wages and terms of payment might be calmly and dispassionately discussed from all points of view, and we might hope for a good result to accrue from the present condition of affairs.

THE NAVAL REVIEW

THE magnificent spectacle on Saturday, June 24th, at Spithead, closing the series of stately ceremonies connected with the Coronation, must have made a deep and lasting impression on the minds of the tens of thousands of those who were privileged to view it. The accounts of the proceedings will no doubt exercise a similar effect upon the minds of millions throughout the world. We witnessed at that Review the embodiment of that national force which has meant so much to this Empire from the standpoint of power, wealth, civilization and freedom. With our great traditions of the past, and the stirring hopes for the future, we have to remember that our position to-day is due to the existence of the Navy in its present form, and it is our duty to realize that our position in the future must largely rest with the soundness of the policy which is to control our actions. It may be said that this Review stands for much that is quite unique; never has such a formidable array of vessels been gathered together, and never have the responsibilities regarding the maintenance of our Empire been more forcibly brought home to us. As an illustration of the character of the Review, this was no assembly of ships collected from all over the place and specially commissioned for the occasion, but the meeting of His Majesty's ships on active service under ordinary conditions and ready for any emergency.

Looking back for the past nine years, since the last Review, it is interesting to note that among the classes of battleships the *Majestic* class is the only one represented in 1902 and in 1911, which illustrates the remarkable development which has taken place in that short period.

THE FLEETS OF THE MAIL LINES.

(From our Own Correspondent.)

The Stranding of the "Ivernia."

THE passage of somewhat more than seventy years has refined the true meaning of the now almost proverbial expression, the "luck of Cunards." It evidently cannot mean that accidents will not happen—we have the burning of the *Lucania*, the loss of the *Slavonia* and the accident to the *Ivernia* all within a few months to show that accidents befall the premier Atlantic Company just as they befall the humbler class of shipowners. But where "Cunard luck" comes in is, that it ensures that the accidents that do happen always occur under such circumstances that no loss of life takes place. It was at about noon on the 24th May that the *Ivernia*, homeward bound from Boston, struck the outer fringe of the Daunt's Rock, and passing over the obstruction made her way in safety to Queenstown, being reported as passing Roche's Point at 1.18 p.m. with already "a heavy list to starboard." By two o'clock she was anchored in the inner harbour and all risk to life was at end. All risk of any kind indeed was thought to be over, for the telegrams printed in the *Shipping Gazette* bravely stated that "in consequence of the vessel being built in water-tight compartments it was found unnecessary to beach her," though she had 25 ft. of water in her fore compartment. Nevertheless by half-past three water had found its way into Nos. 2 and 3 holds, and by half-past five three tugs—one of them a Royal Dockyard tug from Haulbowline—were engaged in beaching the vessel. At high water but a single compartment was dry. On the 26th telegrams from the same official source reported that at 3 a.m. the after hold had filled, that the dynamo was submerged at high water, "the bulkheads giving way." I need not go through the details that day after day have been published. I have quoted enough to make my point. "Cunard luck" was assuredly abundantly clear in the case. The luck came in from the fact that the injuries sustained by the *Ivernia* were sustained from contact with a rock within eight miles of one of the finest harbours in the British Islands, and not from striking a submerged derelict in mid-Atlantic or even from contact with a rock in the neighbourhood of the Fastnet, some sixty miles to the westward of the sandbank on which eventually the vessel was beached for tightening. The vessel took a decided list before she was beached, and after she was over the bank the bulkheads gave way. There could have been little strain on her sub-divisions save from the head of water in the vessel herself when the starting took place. Bulkheads surely are intended to preserve a vessel, even when two of her principal compartments are holed by collision. That is to say, when free water is dashing about from side to side and from end to end of each compartment as the wounded ship moves in a seaway. The bulkheads in this case seem to have given way in still water. Surely modern ship construction has been put to a test in this accident and an explanation should be forthcoming. We need not contemplate what might have happened had it been any other danger than Daunt's Rock which caused such damage as the vessel sustained.

The *Times* on the 14th June called attention to the fact that the divers had found portions of an old wreck wedged into the *Ivernia's* damaged plates, and went on to remind us that the Inman liner *City of Chicago* had been wrecked on the same rocks. This is an entire mistake. The *City of Chicago* went ashore at the Old Head of Kinsale, several miles away, and on the mainland of the Irish coast. It was the first *City of New York* which—if I remember rightly, under Captain Kennedy—went on to Daunt's Rock and became a total loss in the year 1864. Curiously enough, in the beginning of the year 1868 another crack ship was lost off the entrance to Queenstown harbour. This was the new Guion steamship *Chicago*, built some fifteen months previously at Newcastle by Messrs. Palmer. But I do not think her bones can have in any way incommoded the plates of the Cunarder.

The month of June, 1911.

has seen two notable events in the Transatlantic trade. On the 5th June was laid at Clydebank the keel of the Cunard liner *Aquitania*, which is to be the largest vessel as yet designed—eclipsing by some 5000 tons the gross tonnage of

the *Olympic* and *Titanic*. Nine days later the first-named of these two White Star liners sailed on her maiden trip to New York. She kept her schedule date of sailing under exceptional difficulties; for those connected with the strike of seamen and firemen seem to have made a determined effort to prevent her sailing as advertised. Trouble had previously been experienced with the firemen at Belfast, who had been engaged for the trials and for the run round *via* Liverpool to Southampton, but this had been satisfactorily adjusted.

A good deal of confusion

seems to have been caused by the announcement that a 50,000 ton *Imperator* is to be added to the Hamburg-American Company's fleet. Several newspapers thereupon explained that the great vessel now under construction for the Company at Stettin by the Vulcan Company was not—as hitherto believed—to be called *Europa*, but was to have the less hackneyed name of *Imperator*. This does not seem to be the case. The Vulcan Co.'s ship is still to be called *Europa*. There is to be an *Imperator* nevertheless. And she also is to be of 50,000 tons. But she is to be quite a distinct ship, for she will be built at Hamburg by the Blohm & Voss Company. Huge passenger vessels are not hitherto the speciality of this firm of shipbuilders. But they have shown that they can build large and fast vessels, for they have, as yet, had the monopoly of constructing the battleship-cruisers of the "Invincible" class for the German Navy, and they are doubtless therefore fully qualified to deal with even such a difficult contract as the building of one of the biggest ships ever yet designed. So within a period of, say, three years from the present we may expect to see afloat, two German and one British vessels of considerably greater tonnage than the new White Star liners. Speaking of

The White Star Line

reminds me that Mr. H. C. Boyle, R.D., R.N.R., is retiring from the service after thirty-four years' experience of the sea life. He commenced his career in the Leyland Company and then entered the White Star Line. His most recent command—as far as the machinery department is concerned—has been the *Adriatic*, to which he came from the *Baltic*. He holds the South African transport medal and clasp for his services when aboard the transport *Cymric* in the Boer campaign.

The P. & O. Company's

prestige has soon showed its effect on the progress of their latest acquisition, the Lund Line service to Australia *via* the Cape. When they assumed the direction the despatches were maintained at monthly intervals. It is now announced that a new time-table will be inaugurated with the sailing of the steamship *Ballarat*, now under construction, for this side of the Company's activities by Messrs. Barclay, Curle and Co., on the 14th November and that after that date the sailings will be made every three weeks.

The London and South-Western Railway,

by the accession to their fleet of the *Cæsarea* and the *Sarnia*, has found itself in a position to dispense with the services of two of its older vessels, and accordingly there has been a rearrangement of the fleet and a sale of the *Honfleur* and the *Frederica*. The *Frederica* is a twin-screw express steamer built in 1890 at Glasgow by Messrs. J. & G. Thomson, and fitted with new boilers in 1904. She was employed in the Channel Island service and her speed was returned at "19 knots and upwards." The other was a much older steamer, having been constructed in the year 1873, also at Glasgow, but at the yard of Messrs. Aitken & Mansell. The Turkish Government—which has recently been a large buyer of fast steamers—takes the *Frederica*, whilst the *Honfleur* also goes to foreign purchasers.

The American Government's

recent law making the installation of wireless telegraphy compulsory on passenger steamships has caused them to take measures to see not only that proper installations to fulfil the requirements of their laws are fitted aboard the ships, but further to ensure that persons capable of working them to advantage are borne amongst the crews. Accordingly a notice has been issued explaining that wireless operators must understand the adjustment of the apparatus and the mode of correcting faults, as well as the manner of changing from one wave-length to another. They must further be expert in transmission, being capable of proving that they can transmit at least fifteen words a minute on the American Morse system and twelve words of five letters each on the Continental system. Examinations to prove the efficiency of candidates will be held at the United States Navy yards and certificates will be issued to those who show themselves qualified, and every one in charge of an apparatus aboard a passenger steamer plying to United States ports will be required to have such a certificate, though, of course, similar certificates issued by other Governments will be recognised and will exempt the holders from examination in America. The new law under which also this has been provided, comes into operation on the 1st July, 1911.

Turkey is the latest country to consider the advisability of putting itself into wireless communication with the rest of the world. It is contemplating the erection of stations at Smyrna and Tripolis.

The Suez Canal.

The reports of this water-way continue to show indications of the expansion of the world's trade. For the year 1910 the traffic amounted to some 16,581,898 tons as against 15,407,527 tons in the previous year, 13,134,104 tons in 1905 and 9,938,152 tons in 1900. British preponderance in the use of the canal is still most striking. The figures for the companies at the head of the list are as follows for 1910:—

Peninsular & Oriental Co., of London .	1,214,200 tons.
Ellerman-City Line, of Liverpool	1,028,400 ,,
Blue Funnel Line, of Liverpool	999,300 ,,
Hansa Line of Hamburg	831,400 ,,

Owing to the relative average size of their vessels it would appear that the greater number of voyages was made, not by the P. & O. Co., but by the Ellerman-City Line.

The Strike at Southampton

seems to have had the most serious effect of that at any British port, and the steamship owners there have found it necessary to take more drastic measures to cope with it than elsewhere. Though the *Olympic* was despatched to date, it was found necessary to give way to the demands of the seamen, and as they received an increase of pay a voluntary addition was made to the wages of the engine-room staff.

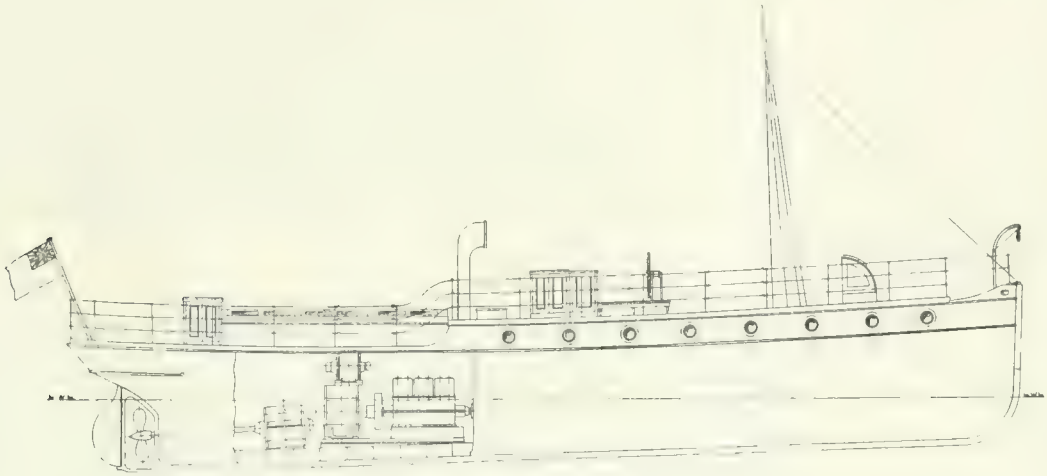
The Russian Volunteer Fleet

has received a contract from its Government for the maintenance of services from Vladivostock for a period of ten years. These services cover regular sailings to the Gulf of Tartary and the Behring Seas. They will bring in a subsidy of some £35,000 per annum to the Company and involve it in an obligation to construct half a dozen steamers in Russian yards.

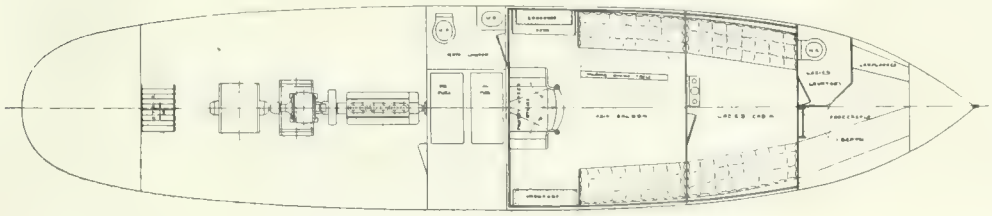
GAS-OIL AND COAL-ENGINED VESSELS.

THE trials of the *Electric Arc* on the Clyde have given to Messrs. Mavor & Coulson some data which will serve them in good stead for future work in the direction of electrical transmission from a prime mover, whether driven by means of steam or gas engines. This experimental vessel of 50 feet long, fitted with an oil engine of 45 B.H.P., attained a speed of rather over eight miles per hour, and was found to be under excellent control in manœuvring, stopping, reversing and starting with facility. The engine speed by revolutions was approximately 800, and the propeller shaft about 400. One of the points demonstrated in the transmission gear is that while continuous current motors may be suitable for certain classes of work, the alternating current is not only more suitable, but even alone suitable for the transmission of large powers for marine work. The interposition of reduction gear between the high speed revolution prime mover and the propeller shaft is generally admitted to be necessary in order to obtain

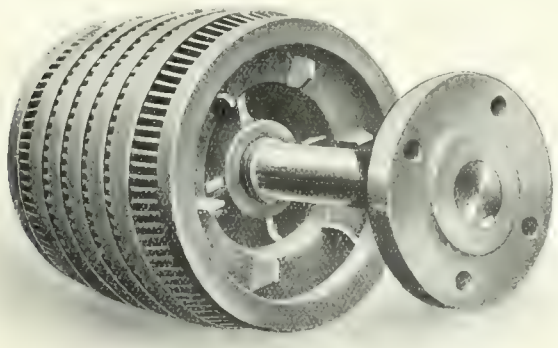
the best and most economical results in respect to both, and working on this principle Messrs. Mavor and Coulson have designed the experimental vessel to demonstrate what they propose. The illustrations given show the vessel and the plan of the machinery. The taxation of the oils used for motors is a subject which provokes discussion in connection with quality and specific gravity, and in some cases which have come under observation, the oil has not proved itself up to that standard of purity which is necessary for reliable and continuous running. The fouling of the chamber and pre-ignition with the consequent hammering are very disconcerting when on a run intended to be full of satisfaction and pleasure to the occupants of the boat.



General Arrangement Elevation and Longitudinal Section of the *Electric Arc*.



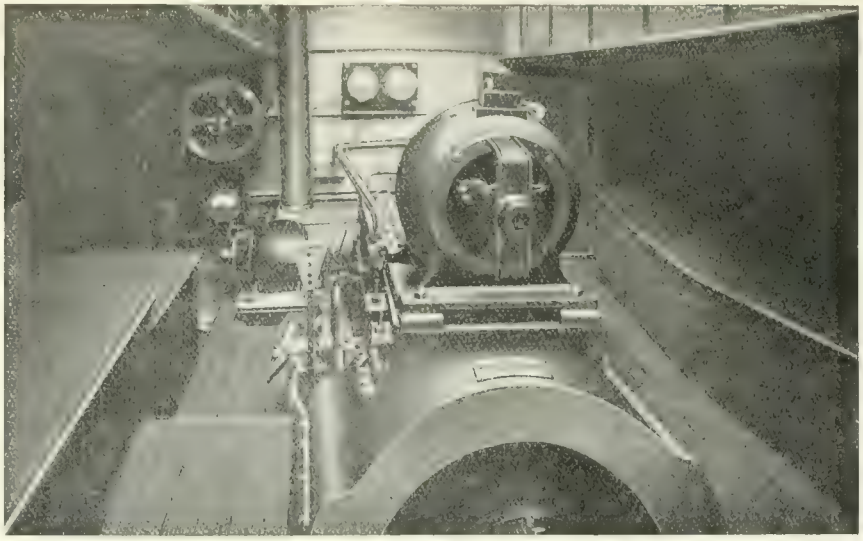
General Arrangement Plan of the Vessel



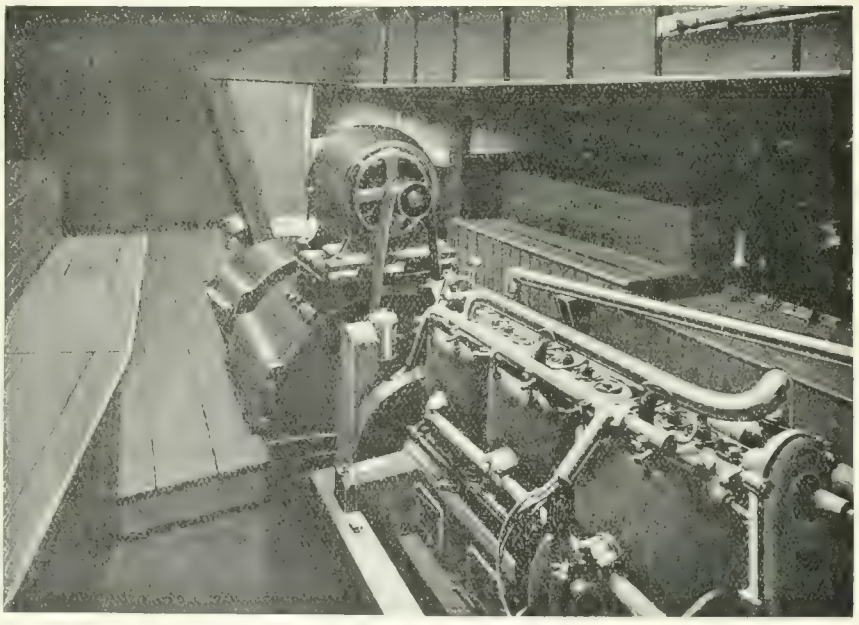
The rotor or running part of the motor which is coupled to the propeller shaft.

The venture, which was referred to in last month's notes, of an interesting kind, with double-acting oil engines, has not been fully developed yet, mainly owing to the difficulty, experienced in running for any length of time, by fouling. The high pressure at which some of the large marine type of oil-engines are designed to work part of the stroke, about 500 lbs., necessitates a good body of metal in the cylinder walls, thus rendering the cooling of the chamber a matter of difficulty to avoid abrasion of the walls by the piston in its movements during the stroke; consideration to this has been given by engine builders with a view to overcome the difficulty; and no doubt at the high pressures and the temperature, the difficulty of adjusting and maintaining the internal lubrication is both apparent and real. In the enclosed crank case, working with compression, the journals are apt to become dry, by reason of the lubricating oil being scoured away; to overcome this pads have been found useful to hold the oil on the bearings. During the month enquiries for crude oil engines have increased, and for larger types than have hitherto been in demand. The report of another large vessel having been placed on order by a Clyde firm, to be fitted with gas engines, has strengthened the view that conviction is growing that this type has entered for practical service. There are enquiries for two small cargo vessels to be fitted with oil engines of 400 and 600 B.H.P. respectively, and also for two passenger vessels to give a speed of 14 knots. As these latter enquiries are from the Continent upon the British market, it may be presumed that engine builders in this country are coming forward to take that place we expressed in former issues

as desirable, in view of the coming market. A valuable demonstration of the utility and economy of the crude oil engine for fishing craft is being given with the Bolinders engine and drifter at Eyemouth. This vessel is the fastest out of this port and appears to be very economical. The engineers and builders deserve a compliment on their enterprise in connection with the runs of this vessel, made to show what can be done in full view of those immediately concerned. Among the builders of paraffin engines Messrs. Beardmore have completed the fitting of their type of engine into a brigantine for the Iceland trade; they are also fitting a set into a new cargo boat for Messrs. Curtiss & Son, Portsmouth; while orders are in hand for Continental firms also at Dalmuir. The gear referred to in our last issue for auxiliary work seems to be growing in favour, as several orders have been placed for the hydraulic transmission driven capstans. Several engine builders are devoting their attention specially to the cycle oil-engine, believing that in this direction lies economy, and from some results gained they seem to be justified. The motor boat race from the Clyde to the Isle of Man, to which reference was made in a previous issue, arranged to take place at Coronation week end, was postponed on account of the weather conditions not being favourable.



The Engine Room at the *Elatus Air*, looking forward



The Engine Room looking aft.

Our 33rd annual volume is completed with the present number. The bound volumes, August, 1910, to July, 1911, comprising 478 pages of extremely interesting matter, will be ready shortly, and orders are now being taken for delivery at the following rates, 7/6 per volume, or by post securely packed, United Kingdom and Canada 8/-, other countries 8/6. Binding cases may be obtained from the publisher, price 1/6, carriage 3d. extra. The index to Volume xxxiii. will be published with the August issue.

NAVAL MATTERS—PAST AND PROSPECTIVE.

(*From our Own Correspondent.*)

Portsmouth Dockyard.

THE Coronation Review and the preparations incidental thereto have overwhelmed everything else at Portsmouth this month. It is unnecessary to go into details, as that has already been done in the daily press. Suffice to say that all that is latest in the way of naval construction was represented. The fleet at Spithead consisted of 167 British warships, these comprising thirty-two battleships, twenty-five armoured cruisers, eight protected cruisers, four unarmoured cruisers, five scouts, two mine-laying vessels, two depot ships for destroyers, sixty-nine destroyers, twelve torpedo-boats (ex-coastal destroyers) and eight submarines. There were in addition eighteen foreign warships. With regard to work, the battleship *King George V.* is making very good progress; it has been arranged that she is to be launched in October. The *Orion* will by that time be almost ready for commissioning. The armoured cruiser *Inflexible* has been in for repairs owing to her having been in collision with the battleship *Bellerophon* on May 26th, during exercises of the Home Fleet off Portland. Strangely enough, the two vessels are commanded by brothers, Captains C. L. Napier and T. W. D. Napier respectively. The stem of the *Bellerophon* took the best bower anchor of the *Inflexible*, which acted as a fender and prevented the full force of the blow being received by the cruiser's side. The damage was on the starboard side about 20 ft. from the stem, where across a space of about ten feet the plates were bulged in and broken from five feet below the water-line downward. Between the 10-feet and 22-feet draught-marks four plates were stove in, affecting three compartments. The King sent a telegram to the Commander-in-Chief of the Home Fleet saying he was distressed to hear of the accident, and was glad there was no serious injury nor anyone injured. The repairs were made good in ten days and the vessel took part in the review. The dockyard staff created a record in the expedition with which the work was completed. The armoured cruiser *Invincible*, which had been in hand for about three months, has had the electrical fittings of her turrets and other defects put right and she has rejoined the Home Fleet. There are at present in hand refitting the armoured cruiser *Drake*, the cruiser *Argonaut*, and the destroyers *Flirt*, *Gipsy* and *Hardy*.

Devonport Dockyard.

During the past month the construction of the battleship *Centurion* has been accelerated by the transfer to her of a large number of men, this having been done owing to the advanced state of the cruiser *Lion* and the completion of a considerable amount of repair work. The hull of the *Centurion* is practically complete up to the level of the protective deck. In the forward section a large number of the side frames which are to support the external armour are fixed, as are many of the upper bulkheads. In the after part the fixing of the A shaft brackets and the hull castings to take the stern shaft bearings is in hand. Everything points to the vessel reaching her launching weight of about 8,000 tons early in November. On the *Lion* very satisfactory progress is also being made, the whole of the main armament of eight 13·5-inch guns being now installed and the work of completing the after barbettes being almost finished. The *Lion* is the first vessel to be completely fitted with so heavy an armament. The main work now is the engine installation, and the port turbines have been lifted on board and got into position. The old battleship *Nile* is being prepared for sale, and her armament, anchors, torpedo-nets and other fittings are being removed. The battleship *Prince of Wales*, the flagship of Vice-Admiral Sir J. Jellicoe, commanding the Atlantic Fleet, recently arrived from Gibraltar to exchange her four heavy guns. The vessel arrived one morning and left for Portsmouth the next, the four old guns having been taken out and four new ones mounted and the gun sights tested in the space of twenty-four hours. It is believed that for rapidity of execution this performance eclipses any work of the kind. A collision recently took place at the entrance to Torquay Harbour between the pleasure steamer *King Edward* and the destroyer *Ranger*, resulting in serious injury to the latter. The destroyer was brought in convoyed by the battleship *Victorious* and was docked. An examination showed that the steamer struck the destroyer about twenty feet from the bow, cutting clean through her side, the hole being about eight feet wide at the top and extending about two feet below the water line. When the collision occurred there were several men in the forward part of the destroyer, but fortunately no one was injured. The damage to the steamer was comparatively small. The destroyer *Salmon* has been paid off in readiness for a refit. It appears that there is a prospect of the boys' training establishment being moved from the entrance of the Hamoaze to a position higher up the harbour, probably above Saltash Bridge. The change is expected to take place when the cruiser *Powerful* replaces the old *Impregnable*. The change will be regretted by many, but the transfer will clear a large area near the entrance to the harbour.

Chatham Dockyard.

We are fairly busy with repair work. The cruiser *Hyacinth*, late flagship on the East Indies station, has been paid off on her return from four years' service and taken in hand for an extensive refit, for which over £60,000 has been allowed. The cruiser *Scylla*, which recently arrived from the North American station, has also been paid off in readiness for a refit, and the cruiser *Pactolus* has been taken in hand for conversion into a depot ship for submarines. The refits of the cruisers *Cressy* and *Dido* and the destroyer *Eden* are not yet completed. Our new vessel the *Chatham* is making headway rapidly, as are also the four submarines. The *Chatham* will, there is every reason to believe, be ready to take the water next month. The destroyer *Ardent*, which has had a lengthened term of service in the Mediterranean, has arrived here and been paid off pending sale. Her place in the Mediterranean has been taken by the *Welland*, which had her crew completed at this port on June 6th and afterwards went to Portsmouth to join the battleship *Exmouth*, which accompanied the destroyer to her new station. The cruiser *Boadicea* has completed refitting; she rejoined the First Destroyer Flotilla in time for the review. The destroyer *Teviot* has had her crew completed for passage to Gibraltar, where she will pay off and be taken in hand for a retubing refit. Her crew will turn over to the *Kestrel*, which has been refitted at Gibraltar and is to return to Devonport to join the Fifth Destroyer Flotilla. Brief reference was made last month to the departure of Engineer-Rear-Admiral C. Rudd. No officer could desire a more enthusiastic send-off than was accorded to the admiral. Every class in the department was represented at the farewell gathering, and there must have been quite two thousand persons present. During the proceedings an illuminated address was presented to the retiring engineer-manager by Mr. Rogers, principal writer, and a photographic group representing the whole of the department by Mr. Williams, foreman. Councillor Holmes admirably expressed the feelings of the workmen towards their late chief, while Engineer-Commander Baldwin testified to the admiration which the present and past officers who had served under Admiral Rudd had for him. As already stated, Admiral Rudd has been succeeded by Engineer-Commander Rawlingson. Another change has been made in the staff of the engineering department, as Engineer-Commander Liversidge, who has been first assistant to the engineer-manager since January, 1909, has been appointed chief engineer at Malta Yard, in succession to Engineer-Captain Hole, who has been placed on the retired list on reaching the age limit. Commander Liversidge's successor is Engineer-Commander Bell, from the battleship *London*.

Sheerness Dockyard.

During the night of June 14th the destroyers *Zephyr* and *Zebra* came into collision at the mouth of the Thames while carrying out night exercises. The *Zephyr* struck the *Zebra* on the port side amidships, sweeping into the sea one of the six-pounder quick-firers and the whaler and davits. Fortunately no one was injured, but it is stated that if the *Zephyr* had not promptly altered her course the consequences might have been very serious. The boats came into harbour next day and were taken into the steam basin for repair. The new battleship *Hercules* arrived here from the builders on June 16th and remained until after the Coronation Review, when she proceeded to Portsmouth to commission for service in the Home Fleet. The battleship *Commonwealth* arrived from

Devonport on June 13th to join the flag of Vice-Admiral Prince Louis of Battenberg for service in the Third Division of the Home Fleet, and subsequently went to Spithead for the review. It is expected that the presentation of a shield, with silver centrepieces, the gift of the people of Australia, will be made while the vessel is at Spithead. The cruiser *Cornwall* paid us a visit at the beginning of the month, leaving on June 10th on a five months' cruise with sixty cadets on board. The battleship *Trafalgar*, which was for some time instructional ship at this port, has been taken away to be broken up. She went down the Medway in tow of dockyard tugs just as she did when she was sent to assist the *Sappho*, which was ashore in Dover Harbour. On that occasion, however, she got up steam while being taken down the river. The old battleship *Camperdown*, which has been used as a berthing ship for submarines at Harwich, is to be sold by auction on July 11th, and she is to be towed round to this port by the submarine depot ship *Vulcan*. The *Camperdown*, which was completed for sea in 1887-88, will be relieved at Harwich by the *Mercury*, the submarine depot ship at Portsmouth. The special service vessel *Elfin*, which foundered in Harwich Harbour at the end of last year with a loss of three men, after being in collision with a submarine, and was raised and brought here in a very battered condition, has been repaired and has returned to Harwich and resumed duty with the submarine flotilla at that port. The destroyer *Recruit* has arrived from Devonport to have her boilers retubed, as well as to undergo a thorough overhaul of her hull and engines. The *Express*, another Devonport destroyer, is in hand, and when their refits are completed they will both return to the western port and join the Fifth Flotilla. The refitting work in hand at the time of writing includes the destroyers *Stour*, *Liffey*, *Usk*, *Dasher*, *Fervent*, and *Boyne*, Torpedo-boats Nos. 19, 20, 112 and 114, and Submarine *C* 9, so it will be seen that we are fairly busy.

Pembroke Dockyard.

The progress of the cruiser *Amphion*, which has been somewhat retarded, will now be accelerated and the framework of the vessel speedily completed. This is in consequence of two gangs of shipwrights having been transferred to her owing to the completion of the third and last of the battle practice targets. As to the date of the launch, it is probable that it will take place before the departure of the *Active* for her steam trials. The four funnels of the *Active* have been erected, and this will permit of the boiler installation being completed. The turbines will be delivered very shortly. It is understood that the steam trials are to take place in October and that the ship will be commissioned before the end of the year. The third attempt to carry out the trial of the destroyer *Coquette* proved successful, and she has gone back to Devonport and joined the Fifth Destroyer Flotilla. The vibrations during the last trial were just as bad as during the previous trials, but the necessary power was maintained and the trial was considered satisfactory. It is understood that the refits of the destroyers *Itchen* and *Kennet* are to be completed in five weeks less than the usual time for such jobs, which usually take five months. The acceleration will be somewhat difficult for us, as it is understood that overtime is not to be resorted to nor are any additional men to be employed. The contract for the winding machinery for the new patent slip has been placed, the estimated cost being £11,708, and the machinery is to be supplied within eight months. The cadet training ship *Cumberland* has paid us a visit of eight days. The cadets were very much interested in the construction of our new ships, and they also visited the workshops and made themselves acquainted with the interior economy of a Royal dockyard. According to a statement made by Mr. McKenna to Major Guest, M.P., the Admiralty have definitely decided not to establish a naval base at Pembroke, but a promise has been made that the yard is to be developed gradually and effectively. This, however, gratifying to the people employed in the yard, is very disappointing. Mr. J. Rogers, assistant constructor at this yard, who served his apprenticeship here, has been promoted to constructor and appointed to Haulbowline. His successor is Mr. C. W. Knight, assistant constructor at the Admiralty, who since the *Boadicea* class has been in construction has had charge of the designs at the Admiralty. He is, therefore, fairly well known to us.

WHITE STAR LINERS "OLYMPIC" AND "TITANIC."†

Passenger Accommodation.—For first-class passengers there are 30 suite-rooms on the bridge deck and 39 on the shelter deck. These are so arranged that they can be let in groups to form suites, including bedrooms, with baths, etc., with communicating doors. But on each of these two decks, close to the companion-ways, on either side, adjacent rooms are fitted up as sitting or dining-room. In all there are nearly 350 first-class rooms, 100 of these being single berth rooms. There is accommodation for over 750 first-class passengers.

For second-class passengers the rooms are arranged as two or four-berth rooms, the total number of second-class passengers being over 550. For the third-class passengers there is a large number of enclosed berths, there being 84 two-berth rooms. The total number of third-class passengers provided for is over 1,100.

The arrangement of the passenger accommodation has been very carefully worked out. There is a first-class main companion-way at the forward end of the accommodation, extending from the boat-deck to the upper-deck, with large halls on each level, while further aft is a second companion-way extending from the promenade deck to the shelter deck. There are two second-class companion-ways, one extending from the boat deck to the middle deck, and the other from the bridge deck to the middle deck, the second-class public rooms being placed between them—*viz.*, the smoke room on the bridge deck, the library on the shelter deck, and the dining saloon on the saloon deck, with the staterooms on the saloon, upper, and middle decks. There are three elevators incorporated in the main companion-way for the first-class passengers, and one in the main second-class companion-way for the second-class passengers. The first-class elevators extend from the upper deck to the promenade deck, with entrances at each deck level. The second-class elevator extends from the middle deck to the boat deck.

On the boat deck accommodation is provided for the captain and officers, containing smoke-room and mess-room. Rooms for the Marconi installation are also arranged in the same house, with the wheel-house and navigating bridge adjoining at the fore end. The first-class main companion-way ending on this deck has a handsome dome overhead in a spacious entrance, and adjoining this entrance is a large gymnasium fitted out with the latest appliances.

First-Class Promenades.—The first-class promenades on the three top decks in the ships are exceptionally fine. The bridge deck (B deck) promenade is entirely enclosed. It is a magnificent space, over 400 feet long, 13 feet minimum width each side of the vessel, and with a solid side screen fitted with the large square lowering windows that constitute one of the most popular features of recent passenger vessels. These windows can be raised or lowered at will, and thus passengers can enjoy the conditions they prefer, having protection from the weather, and at the same time an uninterrupted view of the horizon. The deck above this, the promenade (or A) deck, is the principal promenade, and is entirely devoted to first-class passengers. It is more than 500 feet long and forms a splendid promenade, the width in parts exceeding 30 feet. This is covered by the deck above, but is open at the sides above the bulwark and rail. The topmost deck—the boat deck—also devoted to first-class promenading, is 200 feet long and the full width of the ship.

Disposition of Rooms, &c.—On the promenade deck forward are a large number of the single-berth rooms for first-class passengers, the reading and writing room, 41 ft. by 41 ft., with the lounge adjoining, 59 ft. by 63 ft., and further aft the first-class smoke room, 65 ft. by 61 ft., with a verandah palm court built in two compartments, each 30 ft. by 25 ft. The bridge deck is devoted very

† *Continued from page* 417

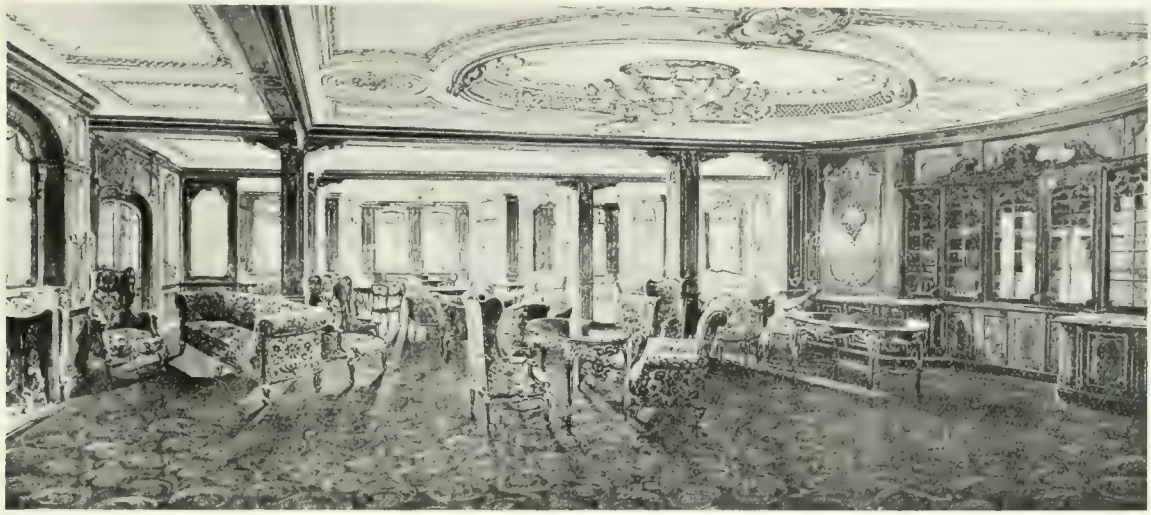
Attention is directed to the November, 1910, number of this Journal, containing a supplement dealing with the building, launch and machinery of the *Olympic*.

largely to single-berth and suite rooms, with à la carte Restaurant, 60 ft. by 45 ft.

On the shelter deck there are a great number of first-class staterooms and suites, special dining saloons for maids and valets, Marconi and postal officials, and offices in the entrance hall, and, abaft of amidships, the second-class library 58 ft. by 40 ft. The third-class smokeroom and general room are under the poop on this level.

First-class staterooms are at the forward end of the main first-class companion-way, and are arranged to accommodate one, two or three passengers. The second-class staterooms are situated immediately abaft the second-class dining saloon, and further aft are the third-class staterooms.

Accommodation is provided on the upper deck for first-class passengers on the starboard side, in one, two and



The Lounge.

1st Class Reception Room.

The saloon deck, as its name suggests, is largely occupied by the dining rooms. Abaft of the grand stairway is a reception room the full width of the ship and 54 ft. long, leading into the dining saloon, which is also the full width of the ship and 114 ft. long, having seating accommodation for 532. The pantries and galleys are abaft this, and then the second-class dining-room, which also is the full width of the ship, is 71 feet long, and has seating accommodation for 394.

three-berth rooms, the accommodation for the stewards and restaurant staff being fitted on the port side off the working passage. Second and third-class staterooms are also provided on this deck.

On the middle deck is situated the third-class dining saloon amidships, extending the full width of the ship, and for a length of 100 feet, with seating accommodation for 473 passengers; the third-class galley, pantries, etc., adjoining. At the forward end, convenient to the first-class

main companion-way, are arranged the Turkish baths, including steam, hot, temperate, cooling and shampooing rooms. Convenient to these are situated two electric bathrooms and also a commodious swimming bath. Staterooms for second-class passengers are arranged for on this deck aft, as well as third-class passengers both forward and aft.

Another innovation on board this ship is the provision of a squash racquet court. The court is situated on the lower deck, and extends two decks high for a length of 30 feet. A spectator gallery is placed at the after end of the court on the middle deck level.

Excellent accommodation for the firemen has been provided at the forward end of the vessel, through the lower, middle, upper and saloon decks, giving access to the boiler rooms by two spiral stairs and tunnel. The arrangement keeps the firemen entirely clear of the passenger accommodation.

The engineers' quarters are on the middle deck, and the mess room, pantries, offices, etc., on the deck above—off the working passage.

The post office and baggage accommodation is arranged compactly in the forward end of the vessel, with the view of expediting the reception and despatch of the mails on the departure and arrival of the ship.

The Steering Gear.—The steering gear fitted on the shelter deck is, as can readily be imagined, very massive, the diameter of the rudder stock—23½ in.—affording some idea of the dimensions. The gear is of Harland & Wolff's wheel-and-pinion type, working through a spring quadrant on the rudder head, with two independent engines having triple cylinders, one on each side. Either engine suffices for the working of the gear, the other being a stand-by. It is so designed as to minimise the shocks received in a sea-way. The spur and bevel gear is of cast steel. The gear is controlled from the navigating bridge by telemotors, and from the docking-bridge aft by mechanical means. In general design the gear resembles that which has given so much satisfaction in all recent White Star ships. The steering gear of a ship is rightly regarded as of the highest importance, and Harland & Wolff's gear has long been recognised as constituting an element in the safety of the vessels in which it is fitted.

The Anchor Gear.—The centre-anchor involved an addition to the usual design of windlass gear, which in these, as in other large liners, is by Messrs. Napier Bros., Ltd., Glasgow, and has proved by the test of time to be very reliable. In addition to working the windlass, one of the two engines fitted drives through worm gear a large drum at the forward end and opposite the central aperture on the stem. This drum is grooved to take the wire rope of the centre 15-ton anchor, adopted instead of the more usual cable. Clutch-engaging and brake gear has been fitted, and every detail embodied to ensure the satisfactory working of the cables under all conditions. A strongly-built crane is fitted at the centre line of the forecastle deck for handling the 15-ton anchor, which is placed in a well in the deck immediately abaft the stem. The capstan gear, operated by steam engines, is also by Messrs. Napier, and includes on the forecastle two capstans worked by the windlass-engines, two with independent engines, and on a lower level one for handling mooring-ropes. Aft there are five capstans, with four steam-engines, one of which actuates two capstans.

Navigating Appliances.—The navigating appliances are most complete. In addition to the two compasses on the captain's bridge and one on the docking bridge aft, there is a standard compass on an isolated brass-work platform in the centre of the ship, at a height of 12 feet above all iron-work and 78 feet above the water-line. Adjacent to the bridge there are two electrically-driven sounding-machines, arranged with spars to enable soundings to be taken when the ship is going at a good speed. All observations can thus be taken under the direct control of the officer in command. The telegraphs are by Messrs. J. W. Ray & Co., of Liverpool, and communicate with engine-room, capstan and other stations. As already indicated, there is also telemotor gear for the steering of the ship. The vessels are fitted with complete installation for receiving sub-marine signals. The lifeboats, which are 30 feet long, are mounted on special davits on the boat-deck. The ship has two masts, 205 feet above the average draft-line, a height necessary to take the Marconi aerial wires, and to ensure that these will be at least 50 feet above the top of the funnels, and thus clear the funnel gases. The masts are also utilised for working the cargo by means of cargo spans, and in addition there is on the foremast a derrick for lifting motor-cars, which latter will be accommodated in one of the foreholds.

Cargo Cranes.—There are three cargo hatches forward and three aft. Two of the forward hatches are served by steam winches, the gins being fixed to cargo spans, while the third hatch—that nearest the passengers' quarters—is served by two Stothert and Pitt electric cranes, designed to lift 50 cwt. They have a radius of 27 ft., a height from the deck to the centre of the pulley of 29 ft., and a total lift of 100 ft. The hoisting motors fitted are of 40 brake horse-power, and the slewing motors 5 brake horse-power. All the hatches in the after part of the ship are served by electric cranes of the same make; two of these are on the promenade deck, there being two small hatches to the hold below, so as to form a minimum of interference with the promenading space. The cranes here are of 30 cwt. capacity, the radius being 21 ft. The height between deck and pulley is 20 ft., while the total lift is 80 ft. In this case the hoisting motors are of 30 brake horse-power, and the slewing motors of 3 brake horse-power. For the remaining two hatches aft there are four electric cranes of 50 cwt. capacity, corresponding exactly with those already referred to, except as regards the radius, which is, in the case of two cranes, 28 ft., and of the other two, 29 ft. The height to the centre of the pulley is, however, slightly less than the forward cranes, being 27 ft. and 26 ft. respectively.

The lifting speed at full load is 160 ft. per minute in the case of the 50-cwt. cranes, and 200 ft. in the case of the 30-cwt. cranes, and increases automatically at lighter loads, whilst the slewing speed in all cases is 500 ft. per minute. In addition to the electric cranes, there are four 3-ton electric cargo winches at the hatches, operating through gins on the cargo spans; also four 15-cwt. electric boat and baggage winches.

Electrically Controlled Watertight Doors.—The watertight doors in a vessel of this size are, of course, a most important item, and those giving communication between the various rooms and engine rooms are arranged, as is usual in White Star steamers, rooms are arranged, as is usual in White Star steamers, on the drop system. They are of Harland & Wolff's special design, of massive construction, and provided with oil cataracts governing the closing speed. Each door is held in the open position by a suitable friction clutch, which can be instantly released by means of a powerful electric magnet controlled from the Captain's bridge, so that, in the event of accident, or at any time when it may be considered advisable, the Captain can, by simply moving an electric switch, instantly close the doors throughout, practically making the vessel unsinkable. In addition to the foregoing, each door can also be immediately closed from below by operating a releasing lever fitted in connection with the friction clutch. Moreover, as a further precaution, floats are provided beneath the floor level, which, in the event of water accidentally entering any of the compartments, automatically lift and thereby close the doors opening into that compartment if they have not already been dropped by those in charge of the vessel. A ladder or escape is provided in each boiler-room, engine-room, and similar watertight compartment, in order that the closing of the doors at any time shall not imprison the men working therein; though the risk of this eventuality is lessened by electric bells placed in the vicinity of each door, which ring prior to their closing, and thus give warning to those below.

The Decorations.—It is impossible to adequately describe the decorations in the passenger accommodation; the ship must be seen and inspected for these features to be fully appreciated. The following brief description of some of the principal rooms, together with the illustrations, will convey some idea of the artistic treatment and luxurious appointment.

First-class Dining Saloon.—This immense room has been decorated in a style peculiarly English—that, in

1st Class Main Staircase.
T.S.S. *Olympic.*

Turkish Bath Cooling Room.
T.S.S. *Olympic.*

fact, which was evolved by the eminent architects of early Jacobean times. For details, the splendid decorations at Hatfield, Haddon Hall, and other great contemporary houses have been carefully studied, the carved and richly-moulded ceilings being particularly characteristic of the plasterers' art of that time. The furniture of oak is designed to harmonize with its surroundings, and at the same time avoid austere disregard for comfort. Five hundred and thirty-two passengers can dine here at the same time; but around the room between the groups of chairs the semi-privacy of small parties has been carefully provided for: there are several recessed bays in which families or friends can dine together practically alone, retired from the busy hum of surrounding conversation.

Reception Room.—Dignity and simplicity are the characteristics of the reception room. Its beautifully-proportioned white panelling in the Jacobean style is delicately carved in low relief. Handsome bronze ceiling lights and wall-brackets, a magnificent tapestry directly facing the staircase, specially woven on the looms at Aubusson, capacious Chesterfields, grandfather chairs upholstered in a floral pattern of wool damask, comfortable cane furniture distributed at intervals, a richly coloured carpet, and the delicacy and refinement of the panelling is the apotheosis, surely, of ocean-going luxury and comfort.

Restaurant.—The Restaurant is of the Louis XVI. period in design, and is panelled from floor to ceiling in beautifully marked French walnut of a delicate light fawn brown colour, the mouldings and ornaments being richly carved and gilded. In the centre of the large panels hang electric light brackets, cast and finely chased in brass and gilt and holding candle lamps. On the right of the entrance is a counter with a marble top of fleur de pêche, supported by panelling and pilasters recalling the design of the wall panels. The room is well lighted by large bay windows, which are divided into squares by ornamental metals bars. Comfort has been well considered in the arrangement of the room. It is furnished with small tables, to accommodate from two to eight persons, with crystal standards lamps and rose-coloured shades to illuminate each table. The chairs are made in similar light French walnut to the walls, and for convenience of service there are several dumb-waiters encircling the columns and forming part of the decorative scheme. On one side is ample accommodation for an orchestra, partly recessed and raised on a platform, flanked on either side with a carved buffet, the top part being a vitrine to hold the silver service, and the lower part for cutlery, thus completing the necessities for a well-appointed restaurant to satisfy every requirement.

Staircases and Entrances.—Leaving the deck and passing through one of the doors which admit to the interior of the vessel, one seems to be entering the hall of some great house on shore instead of being on board a ship. Dignified and simple oak panelling covers the walls, enriched in a few places by a bit of elaborate carved work. In the middle of the hall rises a gracefully curving staircase, its balustrade supported by light scroll work of iron with occasional touches of bronze, in the form of flowers and foliage. Above all a great dome of iron and glass throws a flood of light down the stairway, and on the landing beneath it a great carved panel gives its note of richness to the otherwise plain and massive construction of wall. The panel contains a clock, on either side of which is a female figure, the whole symbolizing Honour and Glory crowning Time. Smoothly-gliding elevators are provided to convey passengers to any of the numerous floors on the ship. The staircase is one of the principal features of the ship, and will be greatly admired as being without doubt the finest piece of workmanship of its kind afloat.

Lounge.—The lounge is decorated in the style which was in vogue in France when Louis XV. was on the throne, and the walls are covered with finely-carved "boiseries," and which, without interfering with the symmetry of the whole, the fancy of the carver has everywhere shown itself in ever-varying details.

Smoke Room and Verandah.—The walls are panelled with the finest mahogany, carved in the taste of our Georgian forefathers, and relieved everywhere with inlaid work in mother-o'-pearl. A fine painting of the Approach to the New World, by Mr. Norman Wilkinson, is in this room. Passing through the silently-revolving doors, we emerge upon a gay little verandah, over whose green trellis grow climbing plants. Set in this flowery arbour are numerous inviting little tables, at which refreshments can be taken in the open air, much as is done in gardens on land.

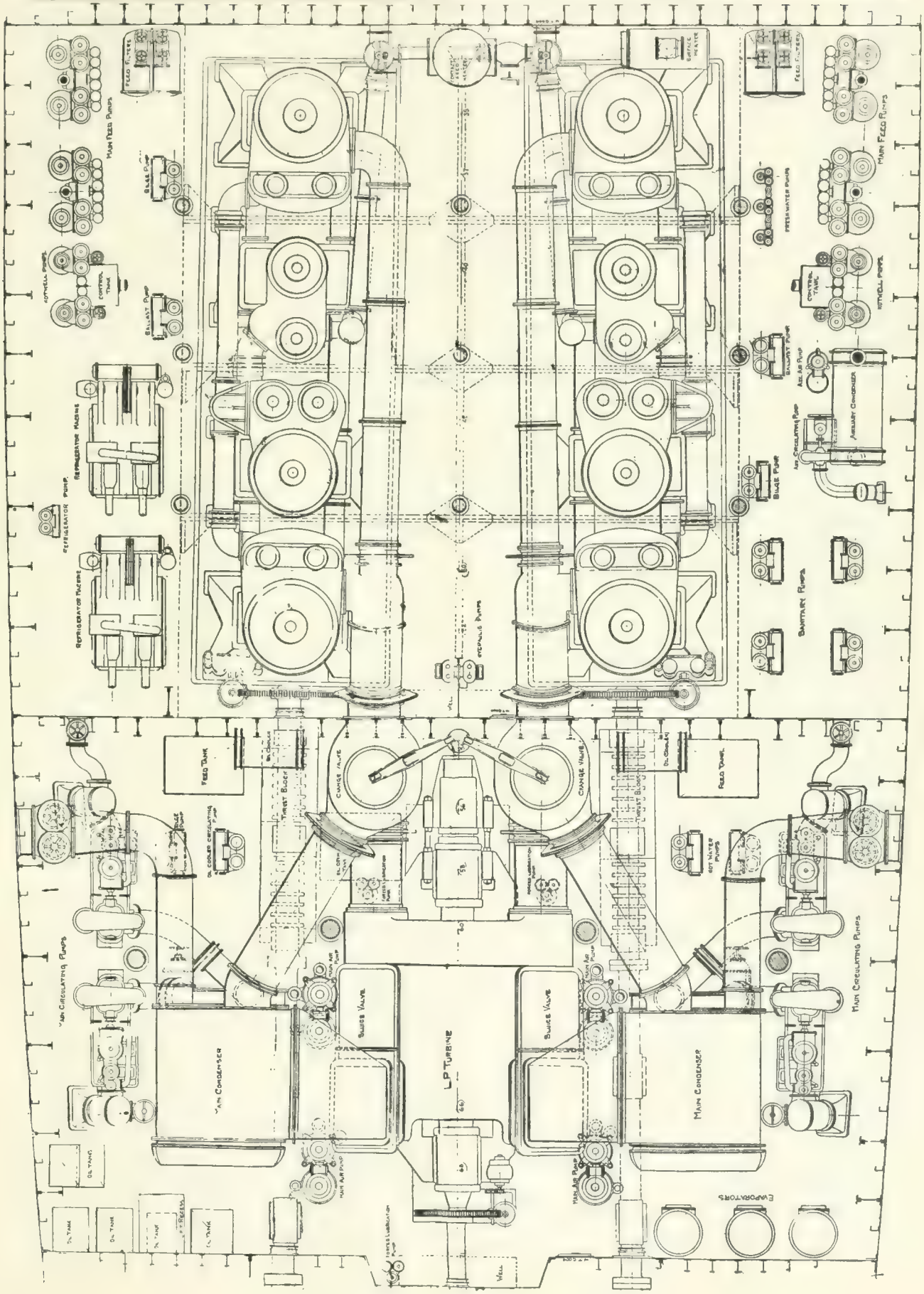
The Cooling Room.—The cooling room on the middle deck in connection with the Turkish baths is in many respects one of the most interesting and striking rooms on the ship. The port-holes are concealed by an elaborately-carved Cairo curtain, through which the light fitfully reveals "something of the grandeur of the mysterious East." The walls are completely tiled, from the dado to the cornice, in large panels of blue and green, surrounded by a broad band of tiles in a bolder and deeper hue. The dado and doors and panelling are in a warm-coloured teak, which makes a perfect setting to the gorgeous effect of the tiles and the ceiling, the cornice and beams of which are gilt, and the intervening panels picked out in dull red. From the panels are suspended bronze Arab lamps. The stanchions are cased also in teak, carved all over with an intricate Moorish pattern, surmounted by a carved cap. Over the doors are small gilt domes, semi-circular in plan, with their soffits carved in a low-relief geometrical pattern. Around the walls are low couches, and between each an inlaid Damascus table, upon which one may place one's coffee, cigarettes or books. As the drinking of fresh water is one of the concomitant features of the benefits of taking the bath, there is a handsome marble drinking fountain set in a frame of tiles. There is also a teak dressing table and mirror with all its accessories, and a locker to which valuables may be committed, whilst scattered around the room are innumerable canvas chairs.

Reading and Writing Room.—The pure white walls and the light and elegant furniture show us that this is essentially a ladies' room. A great bow window almost fills one side of the room, and one may look out past the deck over the vast expanse of sea and sky.

First-Class Staterooms.—The finish and decoration of the first-class staterooms are well in keeping with the excellence of the public rooms; the staterooms are also exceptionally large and beautifully furnished. Perhaps the most striking are the suite rooms, of which there is an unusually large number, decorated in different styles, Adams, Italian Renaissance, Louis Quinze, Louis Quatorze, Georgian, Regence, Queen Anne, Modern Dutch, Old Dutch. Each of the first-class staterooms has a cot bed in brass, mahogany, or oak, and in most of the suite rooms the cot beds are 4 feet wide. This is a distinct feature which will be greatly appreciated by passengers.

Second-Class Accommodation.—In the *Olympic* and *Titanic* it will be found that the second-class passenger has been very generously provided for. Nothing has been omitted in the determination to place the two new White Star leviathans beyond criticism as to the excellence of the accommodation both in the second and third classes.

The Second-class Dining Saloon is situated on the saloon deck aft: it extends the full breadth of the vessel, and is an exceedingly fine room, with extra-large opening pivoted sidelights arranged in pairs. The panelling of this room is carried out in oak, the design of which is taken from examples in the early part of the 17th century, with details of a somewhat later period introduced. There is a handsome sideboard extending the full length of the after bulkhead, surmounted with cabinets elaborately carved. At the forward end a specially-designed sideboard, with piano in the centre, is provided; the furniture is in mahogany, the upholstery of crimson leather, and the floor has linoleum tiles of special design. The Second-class library is another excellent apartment, with panelling in sycamore handsomely relieved with carvings; the dado is in mahogany and also the furniture, which is of special design, covered with tapestry. A large bookcase at the forward end, the windows at the sides, of large dimensions, arranged in pairs, draped with silk curtains, and the handsome Wilton carpet complete the general comfortable—indeed, luxurious—appearance of the room. Second-class Smoke Room—In this room the decoration is a variation of Louis XVI. period; the panelling and dado are of oak relieved with carving; the furniture is of oak of special design, covered with plain, dark green morocco;



General Arrangement of Machinery.—Plan

anced" principle, and in their general design conform with the long-tried practice of Messrs. Harland & Wolff, Ltd. The high-pressure cylinder is 54 inches in diameter; intermediate cylinder 84 inches, and each of the two low-pressure cylinders 97 inches in diameter, the stroke being 75 inches in all cases. The sequence of valves and cylinders is as follows, beginning at the forward end:—Two slide valves, each with two ports in a common chest, worked by two rods through crosshead to single links, low-pressure cylinder, high-pressure cylinder, a single piston valve, two piston valves similarly arranged to the twin slide valves, intermediate pressure cylinder, low-pressure cylinder, and, finally, at the aft end, two slide valves. The valves are operated by the Stephenson link motion.

Forced lubrication is fitted to all the plummer-blocks of the shafting, the oil gravitating from a tank placed high in the turbine engine-room casing to the bearings, at a pressure of about 20 lbs., and draining to tanks low down in the ship, whence it is pumped through a filter and cooler to the high-level supply tank. There is also a water service through the plummer-blocks.

The crank and thrust-shafts are 27 in. in diameter, the line-shaft 26¼ in., and the tail-shaft 28½ in., and they are all hollow, the crank and thrust-shafts having a 9 in. hole, and the others a 12 in. The shafting in all cases was machined at the works at Belfast. There is a loose coupling on the tail-shaft, so that it can be withdrawn from the stern, which greatly facilitates repair. The propellers driven by the reciprocating engines have each a cast-steel boss and three bronze blades, the diameter being 23 ft. 6 in.; and when developing 15,000 indicated horse-power for each engine, the revolutions will be 75 per minute.

Exhaust-Steam Turbine.—The exhaust-steam turbine, by which the central screw will be driven, is of the Parsons type, built to take exhaust steam at about 9 lbs. absolute, and expand it down to 1 lb. absolute, the condensing plant (described later) having been designed to attain a vacuum of 28½ in. (with the barometer at 30 in.), the temperature of circulating water being 55 deg. to 60 deg. Fahr. The rotor, which is built up in the usual way, of steel forgings, is 12 feet in diameter, and the blades range in length from 18 in. to 25½ in., being built on the segmental principle, laced on wire through the blades and distance-pieces, at the roots, and with binding soldered on the edge as usual. The length of the rotor between the extreme edges of the first and last ring of blades is 13 ft. 8 in. The casing is of cast iron, and was manufactured at the Belfast works. There is no astern turbine, as the centre shaft is put out of action when the ship is being manœuvred. The bearings, thrust, and governor, are of the ordinary type adopted in Parsons' turbines. The turbine can be rotated by electric motor, and the usual lifting gear for the upper half of the casing and the rotor is also actuated by electric motor. The rotor has a weight of about 130 tons, and the turbine complete weights 420 tons. The turbine shaft is 20½ in. in diameter, the tail shaft 22½ in., each with a 10 in. hole bored through it. The propeller driven by the turbine is built solid, of manganese bronze, with four blades, the diameter being 16 ft. 6 in. It is designed to run at 165 revolutions per minute, when the power developed is 16,000 shaft horse-power.

Manoeuvring Gear.—Between the boilers and the main steam stop valve there is a steam separator. There are two main steam leads from the boiler-room, each terminating at the stop valve and separator, which are situated against the forward engine-room bulkhead. The stop valves, however, are connected by a crosspipe, with two shut-off valves, so that either steam lead can be utilised for supplying steam to both engines. The main stop valve is of the equilibrium double-beat type, and is operated by hand wheel and screw, from the starting platform, which is situated in the centre of the piston engine-room.

The exhaust pipes from the low-pressure cylinders connecting with the change-valve are fitted with bellows joints, which consist of two discs with special steel rings, and with flanges to take the pipes. The form of the disc-plates enables any difference in length, due to expansion or contraction, to be taken up. In order to ensure absolutely airtight joints, all the pipes in proximity to the condenser are fitted with these bellows joints.

The change-valves for shutting off steam to the turbine and simultaneously opening it to the condenser direct, for manœuvring purposes, are of the piston type with a ring of special form. When the pistons of these valves are in their highest position, steam has a clear flow to the strainer and thence to the turbine; when the piston is lowered the connection to the strainer is closed, and that to the condenser is opened. The piston of each change-valve is suspended to a suitably mounted lever, the other ends of both of which are connected to one of Brown's engines of hydraulic type, adopted in reciprocating engine practice; this hydraulic engine is actuated from the starting platform in the reciprocating engine-room.

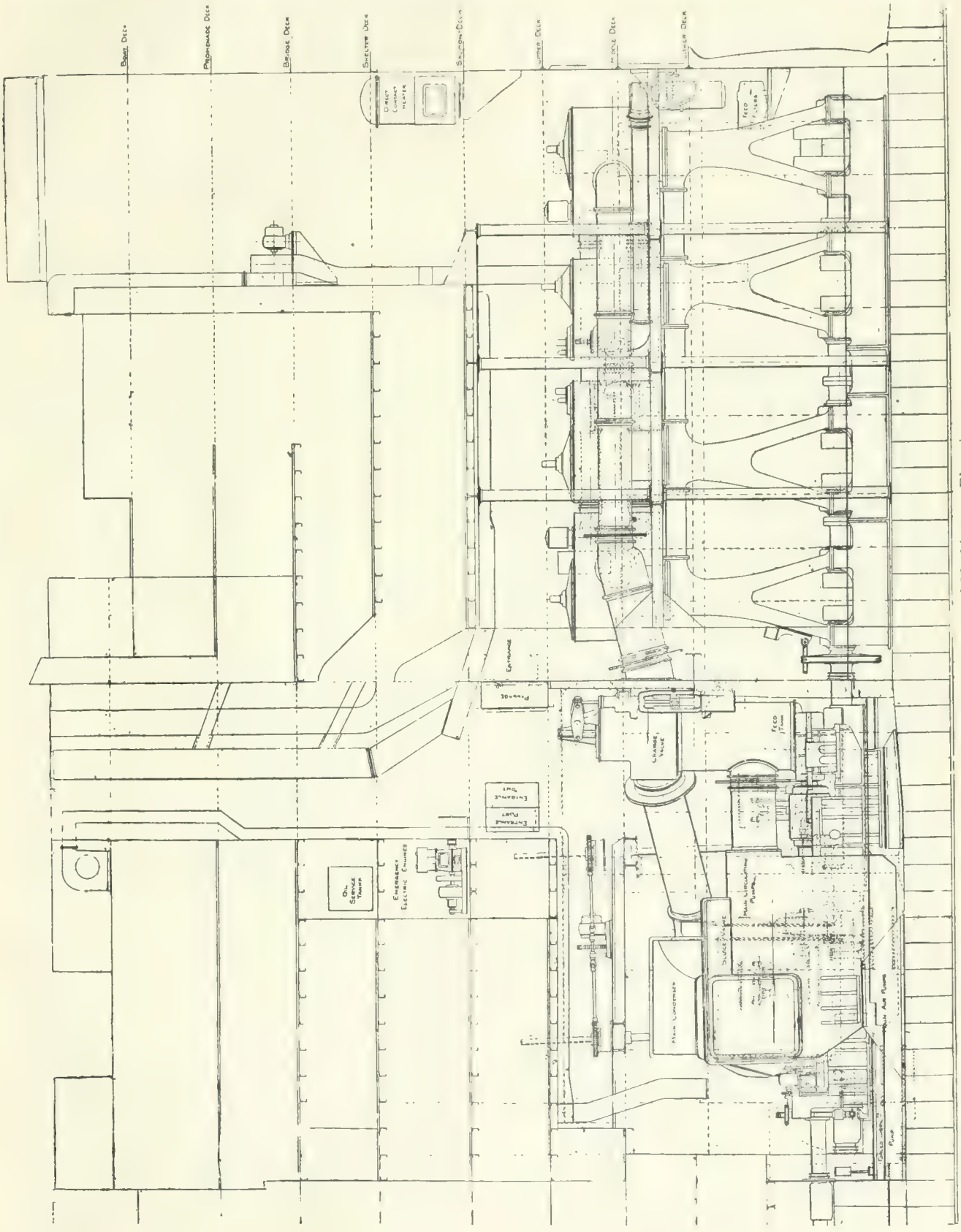
The eduction pipes from the turbine to the condensers are fitted with large sluice-valves, to be closed in the case of accident to the turbine, when the reciprocating engines would exhaust through the change valve direct to the condensers. These sluice-valves are, of course, of enormous area, and the closing slides are in two pieces, worked together through worm and rack gear. These sluice-valves are actuated by electric motors.

Condensing and Boiler-Feed Plant.—The condensers are of a form which has been used for some time on all engines built by Messrs. Harland & Wolff, Ltd. They are of pear shape. As is usual with turbine condensers, the inlet is of the full length of the condenser, and is well stayed vertically by division plates. In line with these there are in the condenser corresponding division plates, which secure an equal distribution of steam over the whole of the condenser tube area. Moreover, the pear shape concentrates the tube surface at the point where the largest volume of steam is admitted—therefore, where it is most needed.

There are four sets of gun-metal circulating pumps, two for the port and two for the starboard condensers, with 29 in. inlet pipes and driven by compound engines of the firm's own make. For each condenser there are two sets of Weir's air pumps, of the "dual" type, both air and water barrels being 36 inches in diameter by 21 inches stroke. The water from each condenser passes into a feed tank, thence it drains into a control tank, from which the hot well pumps draw it, discharging it through the Weir's surface heater to a Weir's contact heater, placed high on the engine-room bulkhead. The surface heater takes the exhaust from the electric engines for heating the feed, while the contact heater utilises the exhaust from the other auxiliaries for the same purpose. The water from the contact heater gravitates to the main feed pumps. Of these there are two pairs on each side of the reciprocating engine-room; two pairs are sufficient to feed the whole of the boilers. The main feed pumps have a diameter of 14 in. by 28 in. stroke, and steam cylinders of 19 in. diameter. The feed pump system is so arranged that all the pumps are interchangeable as far as the feeding of the boilers is concerned.

Refrigerating Installation.—The duty of cooling the ship's provision rooms, which are of very elaborate character, insulated and fitted up in accordance with the standard requirements of the White Star Line, cooling drinking-water, which is supplied at a large number of different points throughout the first, second and third-class accommodation, cooling wine and beer in the bars, also a number of cold lockers in the pantries, larders, etc., making ice, and also for cooling the cargo-beef chambers, is performed by two horizontal duplex CO_2 machines, each of which combines two complete units capable of independent working, so that actually four refrigerating units are provided.

The machines are of the Hall's standard type, the compressors being bored from solid blocks of high-carbon steel, the condenser coils being of solid-drawn copper contained in the base casting, each of which is divided into two casings. Each machine has its own steam surface condenser, brass circulating pump, and air and feed pumps; a duplex brass-ended water pump is also provided as a stand-by. The evaporators are correspondingly divided into four units, and are placed in an insulated recess above the machines at the orlop deck level, at which level the brine pumps—three in number, with interchangeable connections—are placed. The brine return



General Arrangement of Machinery.—Elevation.

tanks are placed at a higher level, immediately above the evaporators. The brine circulation is on the open return system, with separate flow and return on each circuit. All brine pipes throughout are externally galvanized. The various circuits are of moderate length, and are interlaced in the chambers to ensure even distribution of the cooling effect, even in the remote contingency of one section becoming blocked.

Electric Lighting Plant.—For generating electric current for light and power, four 400 kilowatt engines and dynamos are fitted in a separate watertight compartment aft of the turbine room at tank top level. The engines, which indicate each about 580 horse power, are of the Allen vertical three-crank compound, enclosed forced lubrication type, running at 325 revolutions per minute. Each set has one high-pressure cylinder, 17 in. in diameter, and two low-pressure cylinders, each 20 in. in diameter, with a 13 in. stroke. They take steam at 185 lbs. pressure per square inch. The engines exhaust either into a surface heater—which is the usual seagoing condition—or to the condenser. Each engine is direct-coupled to a compound-wound continuous current dynamo, with an output of 100 volts and 4,000 amperes, so that their collective capacity is 16,000 amperes. The dynamos are of the ten-pole type, and are fitted with inter-poles.

In addition to the four main generating sets there are two 30-kilowatt engines and dynamos, placed in a recess off the turbine-room at saloon-deck level. Three sets can be supplied with steam from either of several boiler rooms, and will be available for emergency purposes. They are of a similar description to the main sets, but the engines are of the two-crank type.

The distribution of current is effected on the single wire system, and is controlled and metred at a main switch-board placed on a gallery in the electric engine-room, to which the main dynamo cables and feeders are connected. The latter pass up through port and starboard cable trunks to the various decks, radiating from thence to master switch and fuse boxes grouped at convenient points in the machinery spaces and accommodation, from whence run branches to the distribution fuse boxes scattered throughout the vessel, controlling the lamps and motors.

A complete system of electric lighting is, of course, provided, and electricity is also largely employed for heating, as well as for motive power, including no fewer than 75 motor-driven "Sirocco" fans from 55 in. to 20 in. in diameter, for ventilating all the passenger and crew spaces, as well as the engine and boiler rooms. All fan motors are provided with automatic and hand speed regulation.

Sanitary Fittings.—The Sanitary Fittings supplied to the new White Star Liners are a remarkable feature of their equipment. They illustrate the enormous strides which have been made in the luxurious furnishing of these Ocean Palaces. The object of the builders has evidently been to obtain an installation which for comfort and luxury could not be surpassed and which would embody the latest and most improved sanitation for ship work. The whole installation may be looked upon as a considerable advance on anything which has previously been carried out on board ship.

In order to ensure the work being of the highest quality and to obtain the best results, they placed the work in the hands of Messrs. Doulton & Co., Ltd., Sanitary Engineers, of London and Liverpool, whose experience and enterprise in ship sanitation is so well known. In the state rooms and cabins de lux, the baths provided are a new departure for ship work. They consist of hooded canopy baths with cast iron white porcelain enamelled plunge and earthenware overhead shower which may be easily kept clean. The baths have specially designed controlling fittings for the supplies which effectually prevent any risk of scalding through a bather inadvertently turning on the hot water. The inlets to the baths are steamless and noiseless, and the wastes are of large size so that the baths may be emptied rapidly.

The lavatories have Jaune Fleuri and Fleur de Pecher marble tops, dished and drained to the basins, which are of white Queensware, and the valves are of Doulton's special lever action self-closing pattern with Doulton ware handles, and they are made so that the whole of the working parts may be removed from the top of the lavatory slab without breaking the joints to the supplies. A special feature of the valves is the non-concussive chamber with which they are fitted. This chamber prevents any damage to the joints of the service pipes taking place through the sudden closing of the valves. The wastes and overflows are of large full way pattern and are made so that they may easily be withdrawn for cleaning.

As an instance of how thoroughly the question of quality has been considered, it might be mentioned that the Lavatory Fittings are made of Doulton's special white metal best quality silver plated. The Closet Suites are of Doulton's Patent Single Automatic Back-pressure Valve Type, and are made in white glazed ware. The presence of the automatic valve at the outlet of the closet prevents the back-pressure of air or water in the soil pipe from causing any movement in the water in the trap through the motion of the ship. This type of closet introduced by Messrs. Doulton some time since, has been largely used. It is constructed on the wash-down principle generally adopted for domestic purposes, but has in addition the patent valve at the outlet. The flushing valve to the closet is of a new type, having lever handle; it is self-closing and fitted with non-concussive chamber.

The urinals are of the circular back type which are most frequently met with in hotels and other public buildings. They have, however, several special features which are worthy of note. The white glazed ware backs are made with anti-splash rim in the front so that the flushing water is diverted into the channel. The channels have large outlet at each end of the range. Hinged tread gratings are fixed over a white glazed ware tray which is made in one piece with the channel, and the tread grating is made so that it may be removed for cleaning when required. All parts are easily accessible for cleaning. The divisions of the urinals are in polished Pavonazza and Jaune Fleuri marble.

WAYGOOD LIFTS ON THE "OLYMPIC."

PASSENGER elevators, as well as lifts for mail bags, stores and pantry miscellanea, are now a recognised feature in up-to-date high-class ocean mail and passenger steamers. The lift service for passengers on board the *Olympic*, for which Messrs. R. Waygood & Co., Falmouth Road, London, are responsible, is considerably in advance of what is to be found on any other ocean liner. In both first-class and second-class accommodation, passenger elevators contribute to the comfort and luxury of the passengers. There are three first-class elevators arranged side by side in one trunkway. Each of these can raise a load of 15 cwt. between the upper and promenade decks to a height of 37 ft. 6 in. at a speed of 100 ft per minute. Each cage, made of dark mahogany, measures about 7 ft. in height by 6 ft. in width and 5 ft. 4 in. in depth, having a glass roof, ventilator, and, of course electric lamps. The entrance is fitted with a collapsible gate, which is electrically locked, and must always be closed before the lift can be started. The winding gear is fitted directly overhead, and is driven by a special slow-speed motor to ensure quiet running. The gear consists of a steel worm and a phosphor bronze worm wheel, enclosed in a cast-iron case forming an oil bath. The thrust of the worm shaft is taken by double ball thrust bearings. The gear is fitted with a winding drum, having two steel wire ropes connected to the cage and two separate ropes for the counter-balance weight. An automatic electric brake comes into action when the current is shut off for any reason. The controller for electric operation is worked by a car switch within the cage, and special provision is made to guard against over-running in either direction in case of inattention on the part of the lift-man or any failure in the controller. The cages are guided by round turned steel runners in order to give the smoothest possible movement on the lift, and are

counter-balanced by a cast-iron weight working also on round steel runners. The elevator in the second-class accommodation, also supplied by Messrs. R. Waygood & Co., is practically identical with those in the first-class, except that the cage is more plainly furnished.

CATERING DEPARTMENT OF THE "OLYMPIC."

THIS department looms very largely in the success of the modern passenger liner and the owners of the *Olympic*, evidently recognising this fact, have spared neither pains nor expense to carry the arrangements to a successful issue. Space is absolutely unlimited. Light, drainage and ventilation have all been carefully considered, and above all the apparatus itself is of the most modern type.

The first-class kitchen is fitted with two immense ranges, probably the largest ever made, each fitted with "bain maries" and hot closets on port and starboard sides. Large patent roasters for meat and game, silver grills, steam ovens, brass stockpots, triturators, electric slicing and mincing machines are all most conveniently placed for working. The absence of funnels is a very noticeable feature. They have all been led under the decks, thus minimising radiation of heat in the kitchen itself.

There are two large bakeries for the making of bread. These are fitted with electric dough-making machines, dough dividers, Vienna water-tube ovens, hot-air pastry ovens, provers, etc. In addition there is a special apartment with apparatus for the practice of the confectioner's art, which also includes electric cake making, whisking, freezing machines and hot plates. There are also rooms for the preparation of vegetables, fitted with "Cornhill" potato peeling machines. The restaurant has a special kitchen entirely devoted to it, and this kitchen, though not so large, is just as completely fitted as that already described for the first and second-class passengers.

The third-class passengers have not been overlooked in any respect, their culinary arrangements being absolutely perfect, and including large ranges, steam stockpots, steam ovens, clean steam producers, potato peeling machines and everything likely to assist in preparing food under the most hygienic conditions. The pantries and serving rooms have been arranged with a view to obtaining a rapid service, and are in close proximity to the dining saloons. The installation includes hot presses, hot closets, entrée presses, silver coffee apparatus, automatic egg boilers, "bain maries," milk scalders, and a hundred and one other items that we cannot pretend to technically describe. However, taken on the whole we consider it would be impossible to find anything more complete, either ashore or afloat.

Not only are the first and second-class passengers well provided with pantries and serving rooms, but the third-class passengers are equally well catered for, so that the chance of obtaining a cold dinner on board the *Olympic* is somewhat remote.

The owners evidently hold very strong views on the necessity of absolute perfection in the preparation and serving of food, and much credit is due to Messrs. Henry Wilson & Co., Ltd., of Cornhill Works, Liverpool, who are responsible for the complete outfit of the department.

REPAIR WORK BY THE OXY-ACETYLENE METHOD OF WELDING

AN interesting piece of repair work was carried out in Sunderland last month on the SS. *J. W. Taylor*, owned by Messrs. Taylor & Sanderson, Ltd., of West Sunniside, Sunderland. The work in question was carried out under the survey, and to the satisfaction of Lloyds local Surveyor, and when completed was well hammered in order to satisfy the scruples of that gentleman.

The steamer in question had been in collision, and the stem was very badly bent, so much so that it was impossible to straighten it into position. It was therefore cut about 12 ft. below one of the scarf joints, removed and straightened in the shop, replaced and then welded into position. The section of the

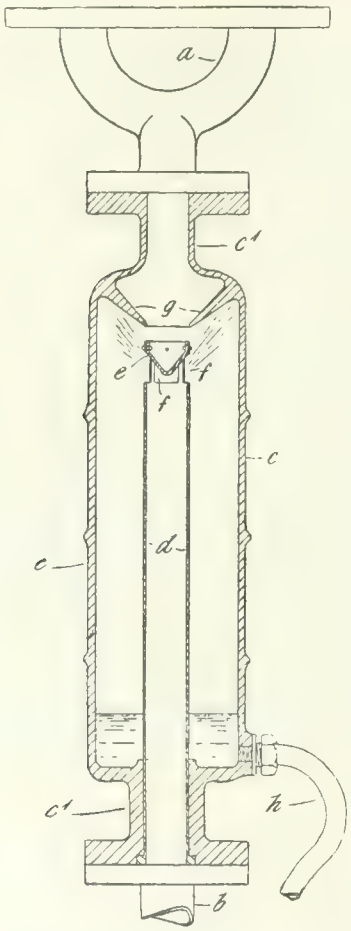
stem is 10″ × 3″ and the total time occupied in welding was nine hours, thus enabling the steamer to take her turn at the coal tips on time.

The repair was carried out at a total cost of about £60 and saved the steamer some eight or ten days' detention, inasmuch as if the stem had not been welded it would have had to be lengthened and another scarf joint made. The method adopted enabled the work to be done with the removal of a minimum number of plates.

The accompanying photograph shows the men at work on a swinging stage, and the whole plant equipment of Oxygen and Acetylene in cylinders is clearly seen in the top left-hand corner. The work was carried out to the satisfaction of the owners and the Local Surveyor by the British Autogenous Welding Co., Ltd., of 268, South Lambeth Road, London, S.W.

SPURGEON'S PATENT STEAM WHISTLE TRAP.

DESCRIPTIVE references have been made from time to time in previous issues to the importance of clear blasts from steam whistles, and to various methods of obtaining these at all times and under all the ordinary circumstances of sea-going conditions. The importance attaching to the instant response of the whistle when required on the steamship is becoming accentuated each year as the highways of the sea become more thronged by traffic, especially in seasons and in localities where fogs abound. The clear and crisp notes necessary to convey unmistakeable meaning through a steam whistle from one vessel to another can only be given



Spurgeon's Steam Whistle Trap.

without hesitation by means of separated or non-saturated steam. The doubts as to the blow through being necessary before the first official blast can then be laid to rest, in place of vaunting themselves in irritating fashion on the bridges of the giving or receiving steamer. Our attention has been called to a recently patented arrangement for separating the water of condensation from the steam in its flow to the whistle valve, and we have pleasure in showing an illustration of it in section. The steam pipe from the boiler is jointed up to a cylindrical casing which is fitted up near the whistle. The casing is large enough to admit of the pipe being carried up inside with an annular space around it into which the water falls and is carried off by a drain pipe back into the water space on the boiler. At the top of the internal pipe, a cone piece is fitted to deflect the steam as it passes through openings around the circumference; the steam, separating from the water particles, ascends, while the water falls into the space around the pipe and drops to the drain at the bottom, thence back into the boiler about the level of the furnace by the force of gravity. At the top of the casing there is another deflecting surface to intercept any water which may be forced upward with the outrush of steam from the internal pipe orifices, and which might otherwise cling to the circumference of the casing and pipe beyond and reach the whistle. The arrangement has the merit of simplicity and it has been already fitted on several steamers with success. The sole makers are Messrs. Reedman & Co., Bradley Street, Canning Town, London, while the patentee is probably known to several of our readers who may remember him at the Royal Albert Dock, London, and subsequently of Alexandria, Egypt.

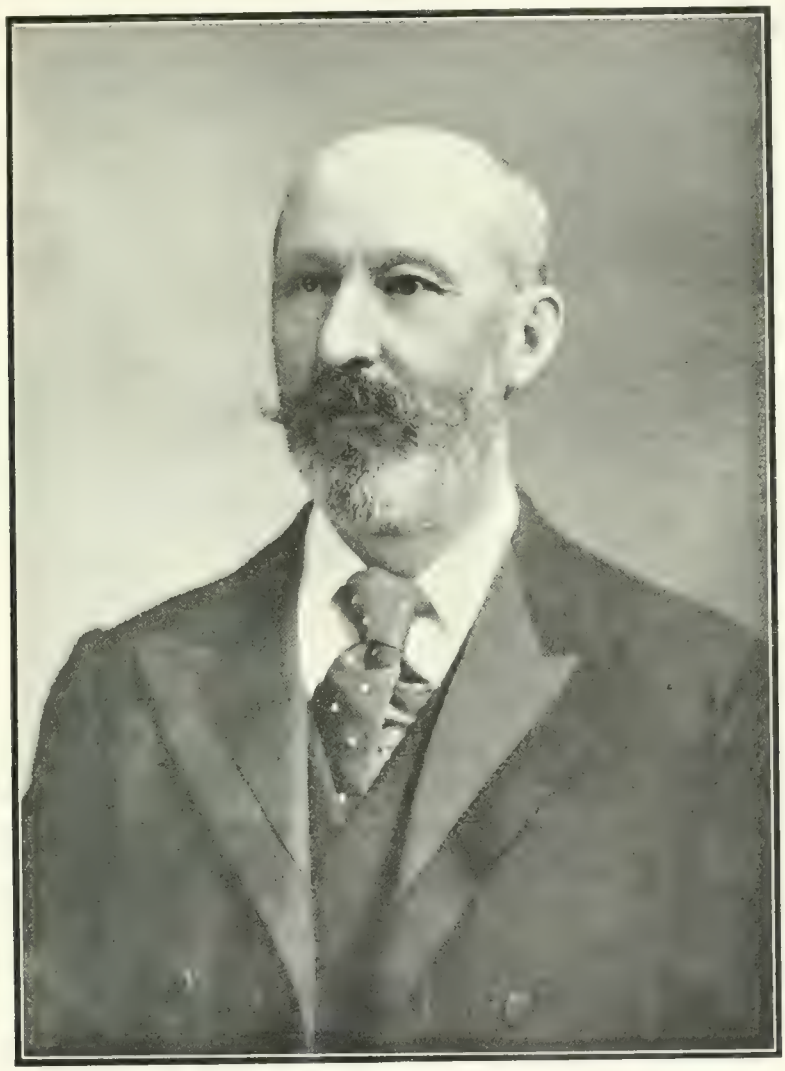
THE NAVAL AIRSHIP.

THE naval airship built at Barrow for the British Admiralty has been towed into her shed again, after having been anchored for but a few days in the Cavendish Dock. During that time, however, one great problem was solved, that of the airship being able to ride at her moorings safely, while her gondolas were floating on the surface of the dock, even with the wind rushing at a rate of 40 miles an hour. The airship made fast to her mooring post met the wind with her blunt bow, with the consequence that her immense length was not affected. It is known that the vessel is undergoing certain alterations in the airshed with the object of stiffening her so as to withstand even greater forces of wind than those experienced when she was out in the open, and it is also intended to equip her with additional means for steering when in the air. It will be August at the soonest when she again appears in Cavendish Dock. In the meantime the present floating mooring post is to be replaced by a rigid post which has to be specially built. It is, of course, known that the vessel will fly easily. She is, indeed, to cover 45 miles an hour in the air, and experts say she will easily accomplish this. But it will depend on the general success of experiments before the work of constructing a second airship is undertaken for the Admiralty. It is known that the experiments already made with No. 1 have placed the Admiralty far in advance of the army in this respect, and also greatly ahead of foreign powers who have already built rigid dirigibles to navigate the air. A little later on the prospect is, nay the certainty is, that an important airship industry will be permanently established in Barrow. Messrs. Vickers, Limited, have achieved a great triumph with the vessel they have built and they have had and will continue to have the advice of the best aeronautic experts in any further developments which may accrue from exhaustive experiments to be undertaken in the air under all sorts of conditions.

OBITUARY.

David John Dunlop.

WITH sincere regret we place on record the death on June 3rd, at his residence, Bath St., Glasgow, of Mr. David J. Dunlop, shipbuilder and engineer, Port Glasgow. Deceased, who was in his 73rd year, had been ailing for some time; but only seriously ill for a few days prior to his decease. With his passing the ranks of Clyde shipbuilders and engineers have been deprived of an able, well-known, and highly respected member; and shipyard workmen of an employer who was ever considerate for their best welfare.



The late David John Dunlop.

Born in Mexico City in 1838, where his father—a Mexican merchant—was at that time resident, Mr. Dunlop while still quite young was brought to Glasgow, and at the High School of that city, as well as at the Collegiate School, Liverpool, received an excellent classical and mathematical education. Leaving the Collegiate School—where he had as school-mate Mr. G. W. Wolff, of Messrs. Harland & Wolff, Belfast—he became apprenticed to the firm of Messrs. Walter Neilson & Co., Locomotive Engineers, Hyde Park Street, Glasgow. After completing his time he received an appointment to proceed to Java with a consignment of sugar plant and superintend its erection and completion. In connection with the starting of the plant he had to design shallow-draft barges, with moveable propellers, by which the cane was brought to the mill. Returning to this country in 1862, and having long before determined upon marine engineering as a profession, he joined the firm of Randolph, Elder & Co., Centre Street, Glasgow. Amongst other work for which Mr. Dunlop was responsible with this firm was the construction, for the French Government, of a floating dock at Saigon, two years being thus occupied. On returning to Glasgow he was at once enlisted on the staff of Messrs. John Elder & Co.—evolved from the firm of Randolph, Elder & Co.—who were then proceeding to lay out new shipbuilding and engineering works at Fairfield, Govan. So satisfied was Mr. Elder with the ability of young Mr. Dunlop that he made him his principal assistant and placed him in charge of the designing and erecting of the offices, shipyard, and workshops. It speaks well for the ability and prescience with which this important work was carried out that in all essentials the establishment of to-day—capable as it is of dealing with the largest and heaviest of shipbuilding and engineering contracts in accordance with the best modern practice—was comprehended in the general lines laid down by Mr. Dunlop so many years ago.

After the death of Mr. John Elder in 1869, Mr. Dunlop

—who retained a life-long admiration for his early chief—joined Mr. James L. Cunliffe (who was also trained in the Elder Works) in taking over the shipyard at Port Glasgow, then owned by Lawrence Hill & Co. Under the firm name of Cunliffe & Dunlop, business was begun in 1870, and the partnership continued until 1881, when Mr. Cunliffe retired, leaving Mr. Dunlop sole partner. Under the altered title of D. J. Dunlop & Co., the business has ever since been carried on, Mr. Dunlop continuing almost till the end to superintend in detail all its operations. He specialised in various classes of vessels: fine steam yachts at first being produced, but later and more notably oil-tank steamers, cable-laying steamers, light-draft vessels for river work, and high-class passenger steamers of medium size. Mr. Dunlop was among the first to recognise the possibilities of the oil-tanker; and he built for the Anglo-American Oil Co. the first vessels which demonstrated the superiority of the system of carrying oil in bulk over that of carrying it in barrels.

He also built the first light-draft vessels which navigated the river Niger; showed the immense commercial potentialities of the region, and led to the formation of the Royal Niger Co. Several of the earliest fruit-carrying steamers and some of the finest cable-laying steamers are also to Mr. Dunlop's credit, one of these latter class being the *Monarch*, built in 1884 to the order of the British Government, and still doing active service in cable-repairing round the British coasts. Not a few ingenious devices connected with shipbuilding and marine engineering have Mr. Dunlop as their author, including "Dunlop's Marine Engine Governor," in which the distinguishing feature consists of automatic control of the engines by sensitive connection with the immersed and emerged condition of the propeller at the stern. Mr. Dunlop was always devising new methods of carrying on the details of his work and never sacrificed quality for cheapness, or undertook contracts simply to swell his annual output. As an employer of labour he won the avowed respect of the men in his own industry and of all his fellow employers. He was an enthusiastic supporter of conciliatory methods of dealing with labour disputes. When the Belleville water-tube boilers were first introduced into this country there arose a serious demarcation dispute between the engineers and boilermakers on the question of which class of men should do certain parts of the work. Mr. Dunlop was asked to act as arbiter in the dispute, and so satisfactory was his finding that it was accepted unanimously by all concerned and still remains the basis on which such work is done. He took a leading part in the formation of the Engineering Employers' Federation, and was at different periods President of the North-West Engineering Trades Employers' Association. His own firm, as a matter of course, were members of the Clyde Shipbuilders' Association and of the Shipbuilding Employers' Federation. His employees in 1895, on the occasion of the semi-jubilee of the firm, presented him with his portrait in oils as a souvenir of the event.

The members of the Institute of Marine Engineers will have pleasant recollections of Mr. Dunlop as their President in 1902. He was a member of the Institute of Engineers and Shipbuilders in Scotland; a vice-president of the Institute of Naval Architects; and a member of the Technical Committee of Lloyd's Registry. He was unmarried and lived with his sister, Miss Dunlop, for whom much sympathy has been felt in her bereavement.

Thomas Reid.

The death is announced of Mr. Thomas Reid, senior of the engineering firm of Messrs. Thomas Reid & Sons, Paisley, well known for their make of medium-sized steam windlasses and winches. Deceased, who had all but completed his 86th year, started business in Paisley on a small scale over half a century ago, and had for a time as one of his best workmen, William Arrol—now Sir Wm. Arrol, of the noted firm of bridge builders. The business as at present constituted dates from 1877; but deceased retired from the practical management of the firm about thirty years ago, leaving four sons to carry on the practical work. Under this arrangement the business has greatly prospered; and the name of Messrs. Reid & Sons, as makers of windlasses, winches, and other deck machinery for steam yachts especially, has long been a guarantee of high-class production. Deceased, who, had he lived till 21st June, would have attained the patriarchal age of 86 years, spent his later years almost constantly at the coast, having a residence at Ardnadam on the Holy Loch. He was extremely fond of yachting; and both his fine personality and his *Ayrshire Lass* were well known in Clyde yachting circles.

THE LEVIATHAN CUNARDER "AQUITANIA."

MESSRS. John Brown & Co., Ltd., Clydebank, early in June began laying down on the berth upon which the vessel will be constructed the keel-plating of the new leviathan Cunarder, *Aquitania*. This vessel, as has before been pointed out, will excel in dimensions any vessel yet afloat; and although the Clydebank works have been laid out for undertaking the construction of ships of great magnitude, a special provision had to be made to accommodate this latest leviathan in view of her exceptional length. The building berth has been specially strengthened for the huge vessel, while in order to allow for its great length, some of the yard buildings have been cleared away and some of the railway lines shifted into new positions. The fitting-out basin has also been lengthened to accommodate the vessel when she is being completed. While the improvements necessitated by the laying down of the *Aquitania* were under way, opportunity was naturally taken to carry out other work of improvement in the yard, all of them of such a nature as will not only facilitate the construction of this particular vessel, but will add to the permanent capabilities of the establishment for general ship-building purposes. Although the laying of the first keel plates early in June inaugurates the construction of the great liner on the berth from which she will be launched, this work does not by any means mark the very first stage in structural operations. The placing of the contract was announced in December last year, and while the building berth was being lengthened, additional piles driven and the other work referred to being carried out, the ordering of the material and its preparation for actual constructional work on the berth has been in progress on a temporary berth. Much has, in fact, already been done; and many constituent parts have been not only machined, but, in part, riveted, ready to be moved into position in an advanced form by the electric jib-derricks fitted at intervals alongside the berth.

COCHRAN BOILERS.—A Cochran Annan donkey boiler, with patent seamless furnace has been supplied and fitted on the S.S. *Corte II*.

THE MCNAB DIRECTION AND REVOLUTION INDICATOR.—The following vessels have had included in their outfit the McNab Direction and Revolution Indicator—*Birchfield*, *Stephano*, *Gloucester Castle* and the *City of Baroda*.

BELDAM PACKING FOR THE "TITANIC."—The Patent Excelsior Metallic Rings (Duplex Type) made by the Beldam Packing and Rubber Co., of London, are to be supplied to the *Titanic*. This packing has been designed in order that the pressure of steam through the neck-bushes of the cylinders shall be gradually counterbalanced and cushioned by the pressure of the other receivers. With this system the rings are maintained in equilibrium, thereby preventing any undue wear, and the rod being subjected to a minimum of friction, the efficiency of the engine is much increased. All the rings are self-adjusting and interchangeable.

ELECTRIC ARC WELDING.

NUMEROUS attempts have been made in the past to weld structural defects in place by means of the Electric Arc, but with only a very limited amount of success, principally owing to the fact that a carbon was employed. In these circumstances, a certain proportion of the carbon combined with the metal, giving a result partaking largely of the nature of cast iron and full of blow holes.

known, and on the arc being struck, a point on the surface under repair is brought almost instantaneously to welding heat, while a drop from the iron pencil (also at welding heat) is added, and the operation repeated till the desired addition is made. The natural flow of material from the positive to the negative pole assists the operator in depositing his drop in the correct position, and particularly so when welding overhead.

From these remarks it will be seen that, as in all such processes, considerable skill is required, and

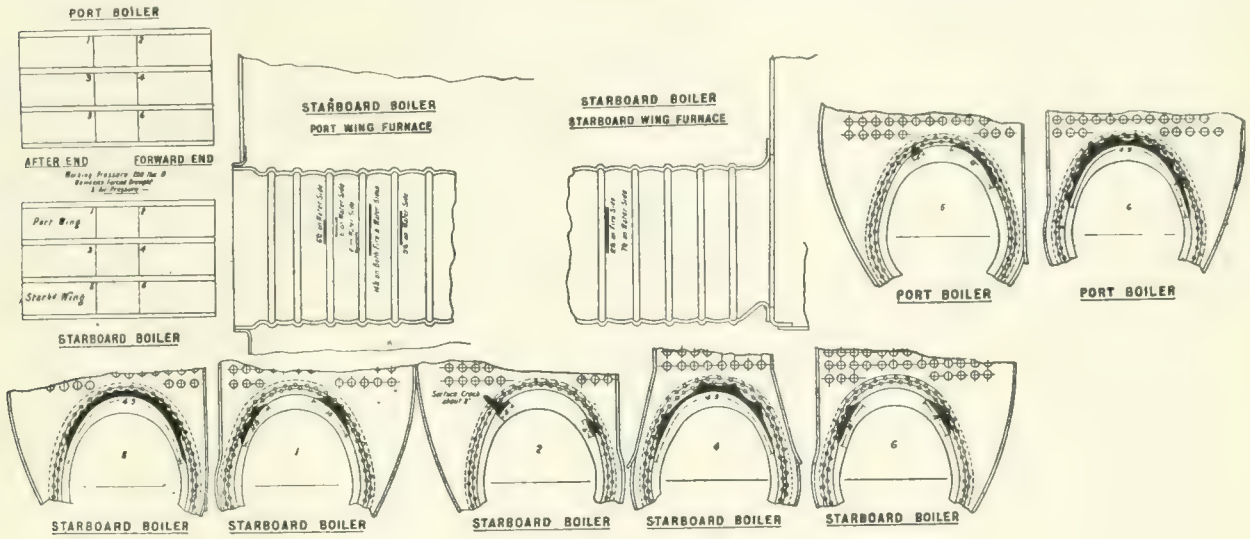


Fig 1

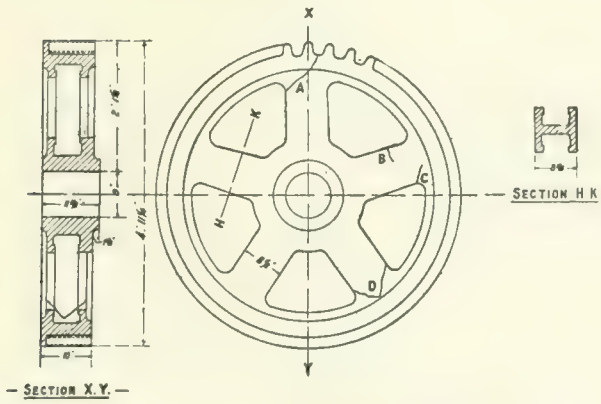


Fig 2

a Both flanges fractured to centre line and partly in rim.
b One flange partly fractured.
c Do , do
d Both flanges and the web fractured. Arm completely separated.

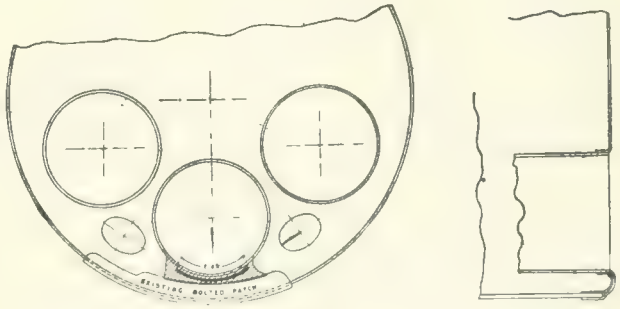


Fig 3

Part cut out and welded up shown in full. The portion thickened up is shaded.

Pommee, of Hamburg, was among these early investigators, but proceeded on the lines of making the welding material itself the positive pole, while the structure under repair is the negative pole, a special flux being also employed to keep the material soft and ductile. This system was developed by Albrecht and Dantz, and early in 1910 the British Arc Welding Company, Ltd. was formed to carry out work in the United Kingdom.

The temperature of the Electric Arc is the highest

that only trained men can be employed. For boiler work at any rate, the writer has made a practice of only training boilermakers, those being preferred who have already had experience with the fire. These men with their previous knowledge, soon get the general idea, and it is then a matter of time to give them the manual skill required. It is undoubtedly a trade to itself, and only arduous apprenticeship can ensure proficiency.

One of the great advantages of the Electric Arc process is that while the temperature is high, the actual quantity of heat generated is small, so that expansion

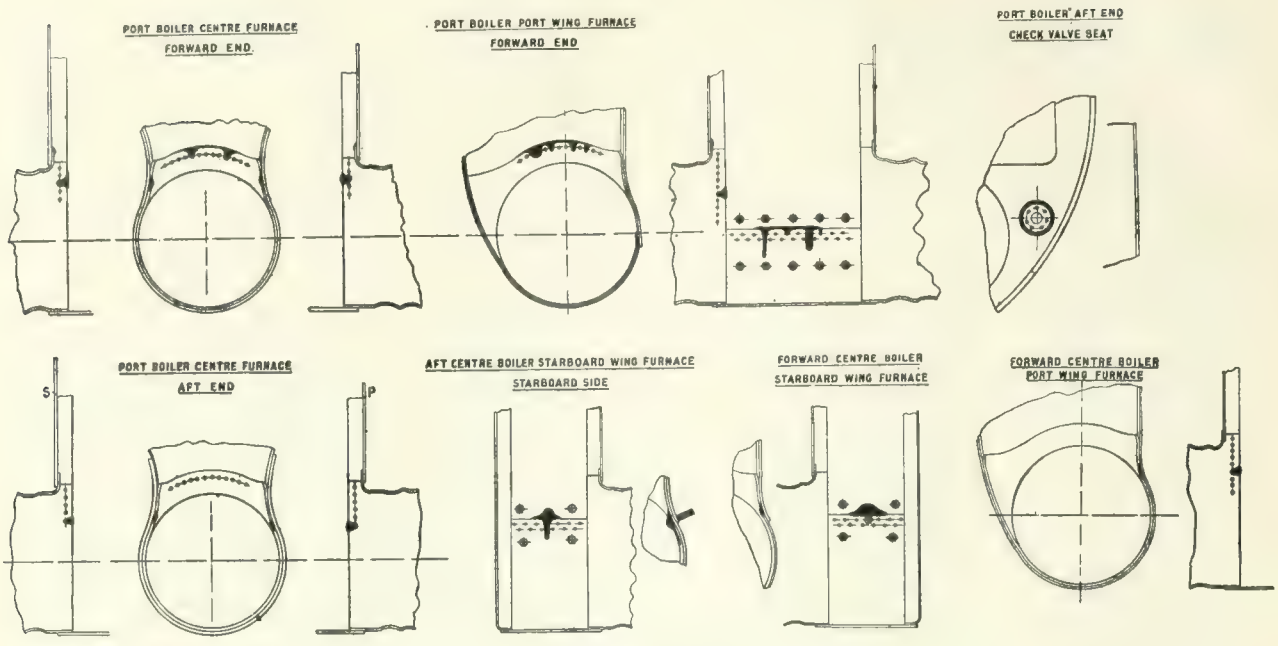


Fig 4
Electric Arc Welding.

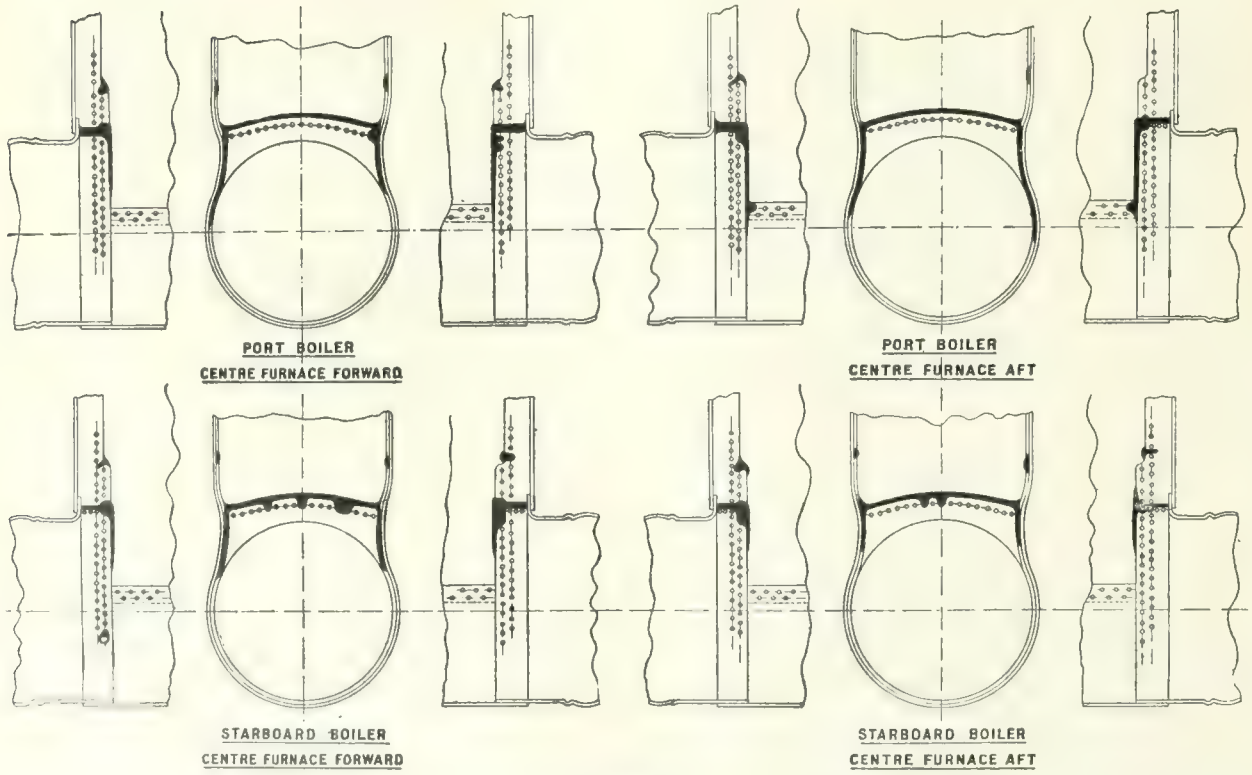


Fig. 5
Electric Arc Welding.

troubles are reduced to a minimum. In no case has it been found necessary to take out rivets, etc., to allow for expansion, and in exceptionally difficult cases, such as sometimes occur with cracks in furnaces, etc., when existing stresses have to be contended with, it is possible to control the heating, the work, of course, taking somewhat longer. Generally speaking, however, the work is rapidly done, and in this respect compares favourably with any other method, while the results are reliable and have stood the tests of long voyages under forced draught.

A few illustrations of work done may give some idea of the results.

Figure 1.—Illustrates repairs to the back ends and furnaces of a passenger liner, running to the Antipodes, which have successfully stood the test of three round voyages. Figure 2.—Repairs to a cast steel gear wheel for the main drive of a bucket dredger. Figure 3.—Crack in end plate of marine boiler, welded up and plate thickened in neighbourhood, the material being welded to an existing bolted patch, without disturbance of the same. Figure 4.—Shows general repairs to boilers of large passenger liner which have now stood successfully for several voyages. Figure 5.—Shows repairs to saddles of furnaces of large vessel, which has just returned from a four months' voyage and reports that the welding is in perfect condition.

These are only a few examples.

The work is being carried on every day, and with numerous cases now in existence, which have been carried out in this country, confidence is being established and the operations extended.

A NEW DESIGN OF MERCHANT VESSEL.*

By MAXWELL BALLARD, ESQ.

Continued from page 405.

THE ultimate object of cargo-steamer design is saving in weight, which means diminished cost and increased carrying power. The above comparison shows a saving of some 19 per cent. of the invoiced material upon the basis of the same specification and carrying power, representing a considerably reduced initial cost, while the relation of the remaining elements of design will be observed to include maintenance and coal consumption upon this basis.

Freeboard requirements may be summed as height of deck platform, the distribution and amount of surplus buoyancy, and the extent to which this is closed in.

The arch-deck platform is raised to the height of the usual midship erection, and the lowest exposed points of this deck at the poop and forecastle fronts are not less than 25 per cent. of the moulded depth above the normal depth line. In estimating the freeboard of the *Edenor*, the arch erection has been treated in the manner provided for similar erections in the Freeboard Tables.

There is in the *Edenor* a surplus buoyancy of 30·52 per cent., or 1,430 tons. The standard requirement for a vessel of this same depth is 24·66 per cent., the difference being equal to 353 tons, or a provision in the *Edenor* of 32·8 per cent. more than required.

In Fig. 6 are given curves of total buoyancy for two vessels of identical underwater form and draught, one being of the Three Island type and the other to the new design. The dimensions are 318 ft. length, 46 ft. 10½ in. breadth, and 20 ft. 6 in. draught. The ordinary vessel has a bridge for 76 ft. and a mean shear of 6 ft. 1½ in., while the other vessel has an arch of 7 ft. 3 in. depth. Under these circumstances there is an excess of reserve buoyancy of 8½ per cent. in the new type. The diagram further illustrates the different distribution and comparative value of the reserve buoyancy.

The absence of wells is noteworthy, and is important in the bearing it has on stability. Cross curves of the latter have been calculated for the *Edenor*, and Fig. 7 gives the stability curves for the two following conditions :—

(1) Load, with 2,140 tons of cargo and bunkers, the former being distributed homogeneously. The vessel in steaming condition.

(2) Coal bunkers full, steam up, but no cargo on board.

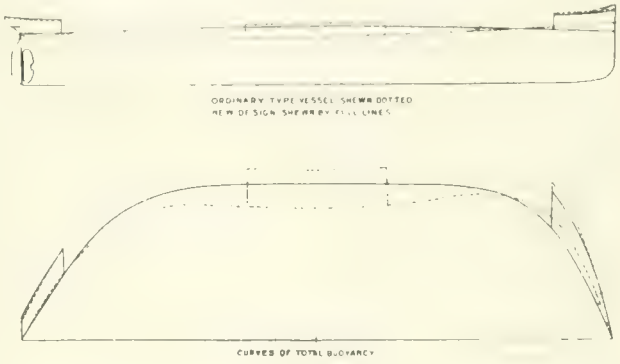


Fig. 6.

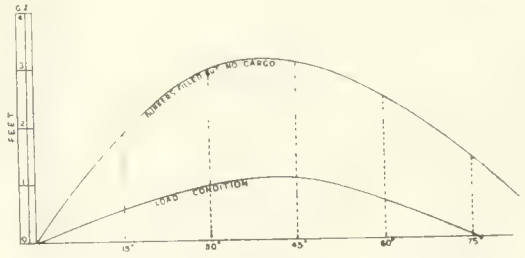


Fig. 7.

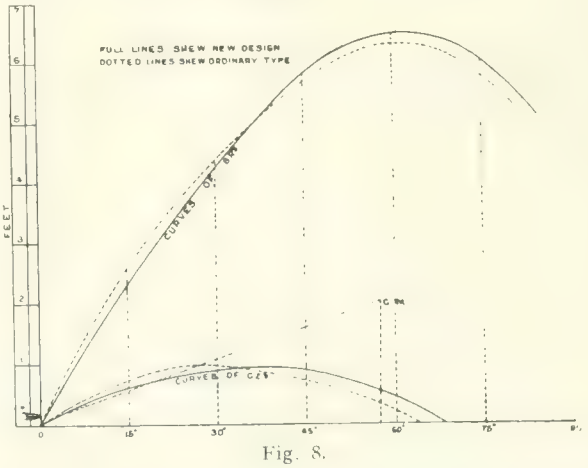


Fig. 8.

In the first condition the metacentric height is estimated to be 2·24 ft., and in the latter case 5·77 ft. In the load condition and under the above assumptions, the maximum righting lever is 13 in. and the range 77½ deg.

In order to compare relatively the stability of the design, curves have been calculated for the two vessels previously mentioned in connection with the reserve buoyancy. These are shown in Fig. 8. Assuming the bridge to be intact, it will be observed that, while the initial stability is decreased slightly, the range is extended.

Scientific considerations and trade conditions are in agreement as to the desirability of the massing of structural elements upon the circumscribing walls. Further, if a ship girder can be deepened, without unduly increasing the transverse stresses in the structure, economy results.

*Read at the Spring Meetings of the Fifty-second Session of the Institution of Naval Architects, 1911.

The deepening of the ship girder by the transverse arch, and the concentration of heavy material in this vicinity, in combination with the decrease of vertical span of unsupported side (in a vessel of the same dimensions and draught), is the *prima facie* case for the arch principle. The effects of redistributing the material and the increase in y, consequent upon the arch form, are shown in Tables III. and IV. of the Appendix. Many cases were examined, and at the same time results for ordinary vessels were obtained. In all cases the data given are based upon the requirements of Lloyd's Register. Referring to the moduli of the sections, and, as is justifiable, comparing these at the weakest sections, they will be seen to be, for the Three Island type, 5,877, for the shelter decker 7,670, and for the Ayre-Ballard type 7,602. Within normal limits it was found that in the new design the modulus varied as the depth of arch.

An investigation of the transverse strength, in the manner put before this Institution by Dr. Bruhn in his papers of 1901 and 1904, has been made. The tables of moments and the results of the calculation are shown in Tables I. and II. (Appendix), and diagrammatically in Fig. 9. For purposes of the calculation, the vessel has been assumed to be at a draught 3 ft. 6 in. deeper than the loadline, and to have a uniformly distributed cargo, these corresponding

Fig. 9

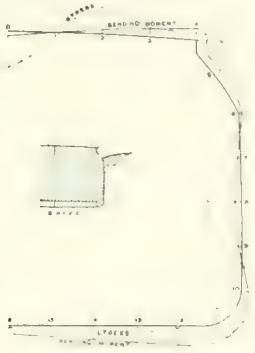


Fig. 11

Fig. 10

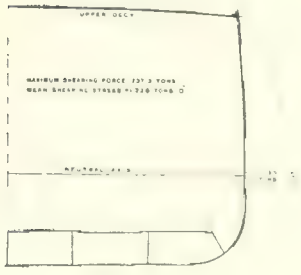
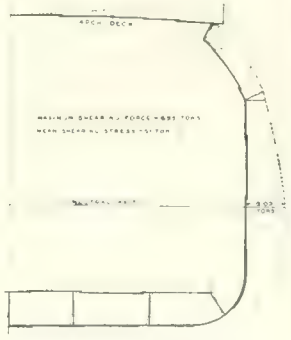


Fig. 12



to the S, (H+V), C conditions assumed by Dr. Bruhn. The inertia was calculated for each position, over five frame spaces, and reduced to the proportion due to one foot length, thus allowing for bracket web and reverse frame support. At the deck centre-line pillar support was assumed, on account of the brackets and girder provided. This is in agreement with the assumption that, while pillar support is efficient for the purpose of assisting the beams, it is of practically no assistance to the double bottom of a single decker. Difficulty was encountered in arriving at the correct neutral axis at the upper "corner," which is of similar construction to that of the *Edenor*. The bending moment and neutral axis must be continuous, however, and with this in mind the curves of these have been plotted as shown. The stresses are given in the table, and the curves are so plotted as to indicate the tendency of the structure to deform.

The distribution of shearing force over the cross section has been investigated, for the vessels above mentioned and of the same dimensions, the results being shown in Figs. 10 and 12. In the new design the stress at the neutral axis is 0·53 ton less than in the case of the ordinary vessel. Assuming an erection in way of the maximum shearing force, as shown by Fig. 11, the stresses are practically identical.

In the decision to utilise longitudinal camber in connection with the transverse arch, considerations included the longitudinal bending moment calculations in order to ascertain the effect upon the new form. The results are given in Tables III. and IV. (Appendix), and the curves of shearing forces, and bending moments for the cases examined are given in Figs. 13 to 15. The calculations were made in the standard method throughout, for the vessels considered, these being of the same dimensions and displacement as previously mentioned, and particulars of which are given at the head of Table III.

Fig. 13.

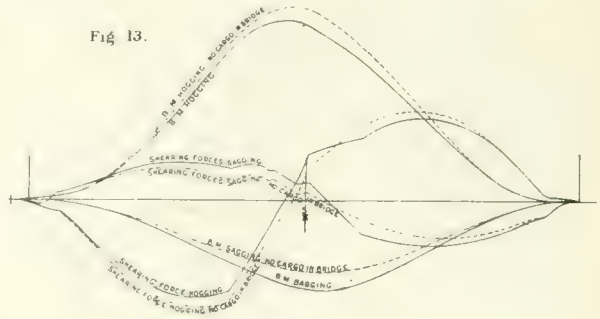


Fig. 14

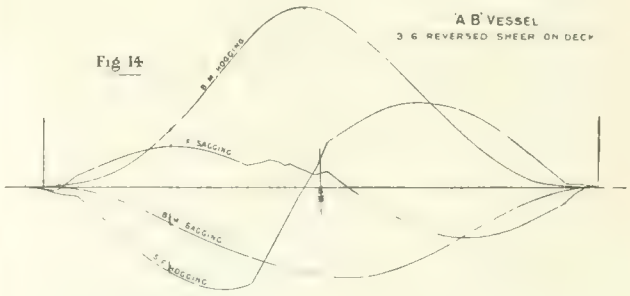
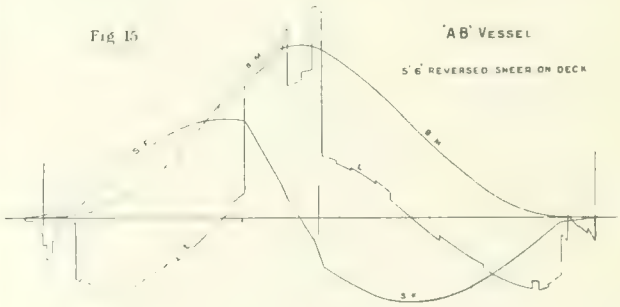


Fig. 15



The curves were worked out by integraph, the maximum ordinate being, in each case, checked mathematically. A distinct argument in favour of longitudinal camber resulted from these calculations.

Selecting two cases and again taking the weakest sections, the reduction in stress is noticeable. Through the hatchway and in way of the well of the Three Island type, the stress is 10·23 tons per square inch; in the new design, and with 3 ft. 6 in. longitudinal camber, the stress is 7·61 tons per square inch, or a reduction of 34·4 per cent. In the shelter decker, the corresponding stress is 8·39 tons, or 10·34 per cent. less in the Ayre-Ballard vessel.

In conclusion, it is hoped that the above particulars may prove of interest to the members of the Institution.

APPENDIX.

TABLE I.

Vessel 318 ft. ×46 ft. 10½ in. ×22 ft. 1 in. plus arch 7 ft. 3 in. Draught assumed 24 ft.
Uniformly distributed cargo in hold. Effect of webs and reverse frames included.

PRELIMINARY TABLE.

No.	Moments. M	Py	Qv	S	H+V	C	F	I.
0	−1	0	0	+0				46·4
1	1	·12	4·73	·13			—	46·4
2	1	·25	9·46	·51			—	46·4
3	1	·48	14·19	1·17			—	308·1
4	1	·70	18·92	1·24			—	1,883
4	−1	—·70	−18·92	+1·24			—	771
5	1	4·20	20·46	1·74			—	771
6	1	8·20	23·08	2·76	+·03		—	606
6	+1	—8·20	—23·08	+2·76	+·03		—	606
7	1	12·50	23·2	2·82	1·19		—	76
8	1	16·81	23·2	2·82	5·14			76
9	1	21·10	23·2	2·82	13·75			76
10	1	25·43	23·2	2·82	33·98			76
11	1	28·35	20·85	·80	53·28	−·43		2,150
12	1	28·80	17·20	—1·98	66·70	6·77	—	4,855
13	1	28·85	12·85	—6·24	91·15	—25·52	—	5,017
14	1	28·90	8·52	−11·08	128·01	—56·22	—	5,179
15	1	28·95	4·32	16·50	177·11	—99·30	—	5,350
16	1	29·00	0	22·53	239·86	−154·81	—	7,110

TABLE II.

No.	Bending Moments. Foot-tons.	Inertia.	y in.	Modulus of Resistance In ³	Stress. Tons per sq. in.
0	— 4·71	46·4	5·98	7·76	7·28
1	— ·728	46·4	5·98	7·76	1·12
2	+ 3·48	46·4	5·98	7·76	5·30
3	+ 7·81	308·1	5·98	51·50	1·82
4	+ 11·56	1,883	16·58	113·6	1·22
4	+ 11·56	771	30·03	25·67	5·40
5	+ 7·30	771	30·03	25·67	3·41
6	+ 3·66	606	26·83	22·58	1·94
7	— 2·49	76	7·27	10·45	2·86
8	— 6·04	76	7·27	10·45	6·92
9	— 2·83	76	7·27	10·45	3·24
10	+ 7·80	76	7·32	10·38	9·01
11	+ 17·04	2,150	29·37	73·20	2·89
12	+ 18·02	4,855	22·36	217·11	·99
13	+ 15·62	5,017	22·36	224·35	·83
14	+ 13·17	5,179	22·36	231·62	·68
15	+ 10·11	5,350	22·96	233·01	·52
16	+ 7·51	7,110	25·82	275·36	·33

Particulars applying to Tables III. and IV.

DIMENSIONS:—318 ft. ×46 ft. 10½ in. ×20 ft. 6 in. draught. Ordinary vessel has a bridge 75 ft. in length New design, arch erection, 7 ft. 3 in. depth.

The standard method of calculation has been followed throughout, the rivets being deducted from material in tension. For the Hogging condition, the holds are assumed to be filled with a homogeneous cargo, bunkers and fresh water tanks empty. Displacement 6,592 tons. For the Sagging condition, the bunkers are assumed to be filled. Displacement 6,992 tons.

Sheer of the Three Island type and the shelter decker is 8 ft. 6 in. forward and 4 ft. 1 in. aft, while the reverse sheer on the new design is in one case 3 ft. 6 in. and in the other 5 ft. 6 in.

TABLE III.

HOGGING CONDITION.

Ship.	Strength taken through.	Moment of Inertia.	y	Modulus of Resistance.	Bending Moment.	Stress. Tons per sq. in. Tension on Deck.	Stress. Tons per sq. in. Compression on Keel.
Ayre-Ballard 7 ft. 3 in. arch 3 ft. 6 in. camber (longitudinal)	Complete deck (plain upper corner)	162,922	19·99	8,152	57,871	7·11	3·71
	,, ,, (extended deck)	170,766	19·68	8,685	,,	6·67	3·64
	Through hatchway (plain upper corner)	151,516	20·48	7,400	,,	7·83	3·79
	,, ,, (extended deck)	154,604	20·33	7,602	,,	7·61	3·77
Ayre-Ballard 8 ft. 3 in. arch 5 ft. 6 in. camber	Complete deck (plain upper corner)	174,512	20·66	8,450	56,678	6·71	3·49
	,, ,, (extended deck)	184,184	20·27	9,098	,,	6·24	3·43
	Through hatchway (plain upper corner)	162,394	20·15	8,060	,,	7·04	3·93
	,, ,, (extended deck)	175,148	20·71	8,460	,,	6·70	3·46
Ordinary Three Island Vessel with cargo in the bridge	In way of bridge and complete decks	201,452	20·63	9,751	60,134	6·17	3·66
	,, ,, ,, through hatchways	183,832	21·21	8,660	,,	6·96	3·82
	In way of well and complete decks	111,990	16·53	6,770	,,	8·89	4·84
	Do., but including sheerstrake doubling	118,812	16·05	7,400	,,	8·14	4·81
	In way of well and through hatchway	100,836	17·13	5,877	,,	10·23	5·02
	Do., but including sheerstrake doubling	110,016	16·61	6,615	,,	9·09	4·88
Ordinary Three Island Vessel not having cargo in the bridge	In way of bridge and complete decks	201,452	20·63	9,751	64,320	6·60	3·91
	,, ,, ,, through hatchways	183,832	21·21	8,660	,,	7·45	4·08
	In way of well and complete decks	111,990	16·53	6,770	,,	9·5e	5·17
	Do., but including sheerstrake doubling	118,812	16·05	7,400	,,	8·70	5·15
	In way of well and through hatchway	100,836	17·13	5,877	,,	10·95	5·37
	Do., but including sheerstrake doubling	110,016	16·61	6,615	,,	9·63	5·22
Shelter-deck Vessel	In way of complete decks	166,564	18·93	8,800	64,320	7·31	4·30
	In way of hatchways	151,514	19·76	7,670	,,	8·39	4·37

TABLE IV.

SAGGING CONDITION.

Ship.	Strength taken through.	Moment of Inertia.	y	Modulus of Resistance.	Bending Moment.	Stress. Tons per sq. in. Compression on Deck.	Stress. Tons per sq. in. Tension on Keel.
Ayre-Ballard 7 ft. 3 in. arch 3 ft. 6 in. camber (longitudinal)	Complete deck (plain upper corner)	165,790	17·426	9,504	29,900	3·15	2·34
	,, ,, (extended deck)	172,926	17·07	10,12e	,,	2·95	2·31
	Through hatchway (plain upper corner)	155,412	17·98	8,650	,,	3.46	2·39
	,, ,, (extended deck)	158,274	17·85	8,880	,,	3·37	2·37
Ayre-Ballard 8 ft. 3 in. arch 5 ft. 6 in. camber	Complete deck (plain upper corner)	177,588	18·03	9,850	,,	—	—
	,, ,, (extended deck)	186,360	17·58	10,600	,,	—	—
	Through hatchway (plain upper corner)	166,454	17·59	9,478	,,	—	—
	,, ,, (extended deck)	178,912	18·01	9,925	,,	—	—
Ordinary Three Island Vessel with cargo in the bridge	In way of bridge and complete decks	199,798	17·95	11,115	29,920	2·69	2·22
	,, ,, ,, through hatchways	182,618	18·95	9,645	,,	3·11	2·28
	In way of well and complete decks	113,448	14·34	7,910	,,	3·78	2·95
	Do., but including sheerstrake doubling	120,872	13·79	8,780	,,	3·41	2·91
	In way of well and through hatchway	103,380	15·03	6,880	,,	4·35	3·04
	Do., but including sheerstrake doubling	111,654	14·43	7,730	,,	3·87	2·98
Ordinary Three Island Vessel not having cargo in the bridge	In way of bridge and complete decks	199,798	17·95	11,115	23,950	2·15	1·79
	,, ,, through hatchways	182,618	18·95	9,645	,,	2·49	1·83
	In way of well and complete decks	113,448	14·34	7,910	,,	3·03	2·36
	Do., but including sheerstrake doubling	120,872	13·79	8,780	,,	2·73	2·33
	In way of well and through hatchway	103,380	15·03	6,880	,,	3·48	2·43
	Do., but including sheerstrake doubling	111,654	14·43	7,730	,,	3·10	2·39
Shelter-deck Vessel	In way of complete decks	165,072	16·41	10,050	,,	2·38	1·98
	,, ,, hatchways	151,954	17·10	8,880	,,	2·70	2·05

SCOTTISH EXHIBITION OF NATIONAL ART AND INDUSTRY.

Marine Exhibits.

(Continued from page 421).

III.

IN a stand of considerable dimensions, MR. CHAS. MCNEIL, of Kinning Park Ironworks, Glasgow, makes an attractive and well arranged display of the specialities in steel hydraulic stampings and forgings for which he has for many years had unequalled reputation, and which are so widely and favourably known in engineering circles both on sea and land. While items in the way of manhole and sludge doors for boilers and ballast tanks, also weldless steel ladles for iron-founders and chemical works, weldless steam domes for boilers and locomotives, and stamped steel pistons are all in evidence in the grouping, attention is specially arrested by items of large dimensions and less obvious purpose. Disposed horizontally and vertically on the stand are a number of curved plates forming the tube receiving section of "steam" and "mud"—or upper and lower-drums in water-tube boilers. One of these, laid horizontally on the stand, 20 ft. 3 in. in length by 1½ in. thick, is the tube receiving portion of a mud drum for a double-ended Yarrow water-tube boiler. Other like items are the tube receiving portions of steam or upper drums of the Yarrow and other water-tube boilers. In addition to shaping these by hydraulic pressure the McNeil firm shape away the longitudinal edges for the proper connecting of the wrapper plate which completes the drum, as well as the end edges for receiving the embossed ends of drum. The latter, containing McNeil's patent door and saddles are also shown in various sizes and shapes on the stand. These tube plates, and flanged and embossed ends with patent doors, for upper and lower drums of water-tube boilers have been supplied to most of the Admiralty contracting firms in this country, and form part of the boilers on board a great number of the cruisers and torpedo-boat destroyers built for the British and other navies within recent years. The firm's circulars give the names of between 30 and 40 vessels having their boilers so fitted, and these and other specialities have been shipped to various continental powers, as well as to Japan and China. Other items on this interesting stand which specially appeal to marine engineers—although from the point of view of good work many items not named are quite as attractive—are stamped steel turbine discs which are made from 3 ft. to 5 ft. diameter; stamped steel skylights for ships' engine room; and hydraulically forged steel pistons which are made in sizes from 3 in. to 5 ft. in diameter. From information gathered at the stand it would appear that marvellous as are the manufactured samples shown, as regards dimensions, shape, and flawless contour—the plant at Kinning Park Iron Works is capable—or being made capable—of dealing with still heavier and more complex work. Steel foundry ladles, for example, which are presently made up to 3-ton capacity out of circular plates 8 ft. diameter, will in a short time be dished out of solid steel discs of 12 ft. diameter and have much increased capacity. The straightening of steel slabs as received from the maker's rolls is now undertaken at the McNeil Works, by which means a considerable saving is often effected through reducing the surplus needed for machining the work to its proper form.

MESSRS. BULL'S METAL & MELLOID CO., LTD., Yoker, in an attractive stand exhibit a variety of examples of their specialised manufactures and samples of the metal-alloys for which they are so renowned. A conspicuous and important item is a full-sized model of the solid bronze propeller supplied to the Allan Liner, *Pretorian,* four years ago. This casting, which at the time was by far the largest and heaviest solid bronze propeller made, had a diameter of 19 ft. 6 in., and a weight of 11½ tons; and its successful use in the *Pretorian* no doubt encouraged the change to solid propellers in connection with the large Cunarders. On the *Pretorian* it replaced a "built" bronze propeller of another make; and the speed improvement realised was fully one knot. This success led to further orders from the Allan Line in connection with their s.s. *Hesperian*—in this case also an improvement in speed resulting of fully half a knot— and their s.s. *Grampian,* etc. Another exhibit representative of special productions which the company are being increasingly called upon to supply to shipowners and ship-builders is a full-size bronze propeller blade whose special feature is a flange of oval form instead of the usual round form. The oval flange allows of a smaller boss being used than that required for the ordinary circular flange, but without reducing strength. Blades of this design mean a saving of about 20 per cent. in weight carried by the shaft and a reduction of about 20 per cent. in cross section through the boss, both of which facts are contributory factors of importance as regards improvement in speed. The Bull's Metal Co.'s stand also contains a variety of samples of Bull's metal and melloid bars for bolts and nuts, valve spindles, pump rods, etc., rolled at Yoker Mills, which are the only brass rolling mills in Scotland. The tensile strength of these metals run as high as 40 tons, and melloid has further exceptional qualities at high temperature, maintaining the strength of steel up to about 700 deg. F. Various samples are also shown of Bull's metal forged in the form of pump spindles, pump rods, and forged propeller blades for torpedo destroyers. Various samples are also shown of ornamental castings and repousse work in melloid and bronze, productions of this class being a new department of the company's work at Yoker.

MESSRS. WAILES, DOVE & CO., LTD., Newcastle-on-Tyne, the patentees and sole manufacturers of "Bitumastic" enamels, coverings and solutions for the prevention of corrosion in iron and steel, and the protection and preservation of wood, at a compactly arranged stand display samples of the application of their well-known specialities. On the model of a vessel's midship section, as well as on a model workshop with smoke stacks, a representation is clearly given of the coating of ship and shore structures with their different "Bitumastic" specialities for anti-corrosion and protection. There is also shown a small-scale model of ship's steel deck-plating flushed up and levelled with patent "Bitumastic" deck covering, similar to that applied successfully to the promenade, shelter, upper, main and lower decks, etc., of the Cunard Co.'s *Mauretania* and other liners. The advantages attaching to the use of this material in place of wood decks are :—There is no piercing of decks with deck bolts; more head room is given in 'tween decks; weight is saved; steel work is efficiently protected; it is cheaper and more durable than wood; and corticine, rubber tiling, and parquetry are easily laid on. In addition, there is more perfect sanitation, more air space; and there is no accumulation of foreign matter, as is usual, under wood decks. Proof of the effectiveness of "Bitumastic" enamels is here illustrated by the condition of iron bolts after submersion in a chemical solution. The parts not coated with "Bitumastic" enamel are badly corroded by the acid, but the remaining portions show no sign of deterioration, the enamel being absolutely unaffected. This firm's whole business is the manufacture of "Bitumastic," its great success having made it known all over the world. Apart from executing very large orders on board such important liners as the *Mauretania* and *Lusitania,* this firm's latest advance is the application of "Bitumastic" to all valuable steel and iron structures and plant on land, such as bridges, water tanks, refrigerating plant, roofs of buildings, etc.

MESSRS. MATTHEW KEENAN & CO., LTD., whose Glasgow works are at 80, Great Wellington Street, put on exhibition samples of their specialities in non-conducting materials and compositions. Of perhaps special note is their patent non-conducting vegetable pulp composition for covering boilers and steam pipes working at high pressure, which has been applied for many years to high-class steamships, including all the ships built by the P. & O. Co. for the last half century. Other items shown are samples of Magnesia Sectional Covering for steam pipes working at medium pressure, and for exhaust pipes; fossil meal composition, very extensively used for covering boilers and steam pipes; and asbestos millboard felt canvas used for covering steam and exhaust pipes. Covering materials, for fitting in sections, in Keenan's composition—felt, cork and asbestos—are in evidence; as are also samples of asbestos—rope canvas—

covering and asbestos mattresses, the latter of which, as is well-known, are often used for insulating boiler-bottoms. These mattresses are made in hand-sections and can easily be removed and replaced.

MESSRS. REID, MCFARLANE & CO., LTD., Hyde-Park St., Glasgow, in an effectively grouped stand, show some of the latest forms of insulation as adopted in the British and Foreign Navies; the merchant marine; in power-houses of factories, collieries, electric light stations, shipyards and other industrial works. Various forms of plastic non-conducting covering for steam boilers and pipes are shown, such as diatomite or fossil meal composition and asbestos composition; also a large variety of sectional coverings in maxonite, fossil meal, asbestos, fire-felt and magnesia. Other classes of covering shown are asbestos-millboard, hair-felt sewn up in canvas, asbestos-rope lagging sewn up in canvas or in asbestos cloth, asbestos mattress lagging coverings for flanges, either in asbestos-mattresses, galvanized sheet-iron boxes lined with non-conducting material, or planished steel boxes lined in a similar manner.

The coverings above mentioned are principally used in connection with the insulation of heat; but for the insulation of cold and sound the firm show their preparations in "Lantos" compressed granulated cork. These are in panels of various sizes, cut to suit positions in bricks of standard size suitable for forming partitions, also covered with plaster, tongued and grooved to fit together, suitable for partitions in buildings and elsewhere. For covering ice, water, brine or ammonia pipes in connection with refrigerating plants, "Lantos" cork sections are made, to fit any size of pipe and to any thickness, protected outside with special bitumen composition impervious to air and moisture. "Lantos" cork bath-mats, life-buoys, etc., are also in evidence.

MESSRS. J. A. RUDD & CO., engineers and machinery merchants, Glasgow, at a large stand make effective display of various machines and apparatus for which they are the agents, marine items being conspicuous. Morrison's Evaporator for marine engines is too well-known to need more than simple mention, but the type shown is an entirely new design, approved by the Admiralty and known as the vertical radial type.

The contraflo winch condenser has already been fitted to a large number of steamers, and is making great strides in popularity. Its sectional design makes drainage perfect and constant, and succeeding sections come into operation automatically as the amount of steam to be condensed increases. It is scarcely necessary to say anything at this time of day about the necessity for winch condensers. That is admitted, and it only remains to make a wise selection. The one exhibited is certainly very compact and highly efficient. It is shown with a simple but ingenious grease extractor, the effectiveness of which is vouched for by the makers—Messrs. Richardsons, Westgarth & Co., Ltd.—who are also the makers of the pulsator drain traps shown in the same stand.

The COCHRAN BOILER figures largely on this stand, both in photos, models and literature. It is a general favourite both for land and marine work, and for design and excellence of workmanship.

MESSRS. MATTHEWS & YATES, LTD., Swinton, Manchester, on stands Nos. 432-3 in Kelvin Hall, exhibit a number of their well-known cyclone specialities. A prominent feature in the display is a small-size cyclone dust plant comprising essentially a cyclone centrifugal fan, cyclone separator and connection trunking. This convincingly demonstrates how light material can be collected and then deposited where desired by the use of air as a conveyer. Plants of this type are now extensively used in saw mills, joinery works, textile works, etc., all over the world. Cyclone-induced draught for boilers is exhibited in model form, from which it can be seen how conveniently this system can be applied to existing boiler plants. Near at hand is an actual cyclone-induced draught set, composed of a centrifugal fan direct-coupled to a cyclone motor. A cyclone electric blower, suitable for the high pressures required in cupola and forge work, is an item on the stand attracting close attention. It is considered by the firm one of its greatest successes. A range of cyclone electric fans, suitable for direct and alternating current, make an interesting show, while special attention may be directed to the cyclone motor. This item suggests at once to the practical eye a machine combining rigidity and strength of design with a pleasing appearance.

Within an asbestos-lined house, an exhibition of the capabilities of the cyclone acetylene generator and welding blow-pipe is given. This form of using the combined oxygen and acetylene process of welding and cutting metal is not yet fully understood by those to whom it would be an immense boon. The enterprise of Messrs. Matthews & Yates in giving such a public display of its capabilities and universal use cannot fail of due appreciation.

CHEMICAL, ENGINEERING AND INDUSTRIES EXHIBITION.

THIS exhibition was held in the Agricultural Hall, Islington, from May 13th to 27th. Among the exhibits were several of interest to marine engineers, which we may briefly refer to. Messrs. Houghton showed specimens of their cast-iron chests for cocks and valves, packed with their special thread white metal packing, of which samples were on view, also specimens of their special iron, suspended in different kinds of acids to prove its capability of resisting the action of such and of its fitness for work in connection with the manufacture of chemicals, or where these are used in various processes—refrigeration and other. Messrs. Bennet Lawes & Co. had a good stand, where were shown illustrations of their special cement applied to iron for preservative purposes, to prevent rust and deterioration on rails, girders and other structures exposed to wet and moisture; non-conducting cement for pipes of a hard and durable nature, etc. The other manufactures of this firm are tartaric or citric acid, cream of tartar and carbonic acid gas. Messrs. Townson & Mercer showed an excellent assortment of their analysis and testing apparatus. Messrs. Read, Holiday & Son had a very interesting stand, illustrative of the distillations from coal tar, with the various colours derived therefrom. A model lighthouse was used to display the different colours by means of manufactured yarns—red, orange, yellow, green, blue, indigo and violet. Lighting and welding were illustrated and the latter process demonstrated by Carbic Ltd. By the use of Carbic Cakes, it is claimed that high purity of gas can be obtained, making it of great value both for illuminating and for oxy-acetylene welding. Messrs. Watson, Laidlaw & Co., Glasgow, were represented by their well-finished centrifugal machines. The ventilating system and apparatus for purifying the air, the production of ozone and the sterilization of water shown by Ozonair Limited were well displayed. The economic value of recording instruments for registering continuously the analysis of flue gas, so that stoking may be raised to a fine art by observation of the indicator, was proved by demonstration at the stand of the Auto-Recorder Co. A sample of fire-bars after four years' service was also on view at this stall in connection with a special system of draught furnace. Messrs. W. H. Bailey & Co. exhibited specimens of their manufactures, pumps, valves and cocks; vacuum pumps of highest efficiency; steam pressure recorder and diagram to show the variations during working hours; water gauges and other engine and boiler fittings. Messrs. J. & P. Hill, Sheffield, showed very effectively the Galloway-Hill patent furnace, designed for the best possible conditions of obtaining the highest value in the combustion of fuel and elimination of smoke. Samples of fire bars which had been in use for several years unimpaired were also shown. During the exhibition a lecture was given each evening, the subjects chosen embracing the principal exhibits on view. These lectures were of high educational value and were well attended. A band discoursed pleasant music in the Hall and added to the general attraction.

METALLIC PACKING FOR THE "OLYMPIC" AND "TITANIC."—All piston rods and valve rods of the main engines of the *Olympic* and auxiliary engines are fitted with metallic packing made by the United States Metallic Packing Co., Ltd., of Soho Works, Bradford. The Company's metallic packing is also to be supplied for the auxiliary engines of the *Titanic*, launched on the 31st May last at Belfast.

REVIEWS.

The Design and Construction of Ships. By John Harvard Biles, LL.D., D.Sc., London. Charles Griffin & Co., Ltd. 25s. nett.

This book is the second volume of the work which was promised when the first volume was published. It was originally intended to have completed the work in two volumes, but the rapid growth of material and the decline of available time has determined the author to publish this second volume somewhat in advance, and leave the remainder of the subject to a later volume. The present volume comprises 425 pages of letterpress and 316 illustrations, including four folding plates, and deals with the subjects of stability, resistance, propulsion and the oscillations of ships. We congratulate the author on his frankness and justice in paying tribute to those who in the past laid the foundations of the methods upon which eminent naval architects have built up the exact science of the subject as understood to-day. It is pointed out that the laborious calculations of former years can now be avoided by the use of such instruments as the planimeter, the integrator and the integraph, thus enabling a much less highly skilled class of calculator to undertake the work with good results. With regard to the oscillation of ships this is the least fully developed of the four divisions of the volume, and the extreme cases dealt with by the elder Froude are only dealt with—1st, where the periods of the wave and the ship equal one another, resulting in excessive rolling; 2nd, where the ship's period is indefinitely great compared with that of the wave, resulting in the ship remaining upright; and 3rd, where the ship's period is indefinitely small compared with that of the wave, in which case the ship's mast follows the wave normal. It is pointed out that the first is very unusual and the second and third are unreal cases. The intermediate conditions have not been investigated thoroughly, though at sea many of them have been practically experienced in all kinds of ships. We are sure that the second volume will be appreciated by those for whom the book is written and the issue of the third volume will be looked forward to with much interest and expectancy.

Engine-Room Practice. By John G. Liversidge. London: Charles Griffin & Co., Ltd. 6s. nett.

This work was written as a treatise on the practice as to the handling of machinery particularly on boardship. It contains very largely the methods of treatment as adopted in the Royal Navy. In the several editions already published novel points have been introduced, for example in the fifth edition the management of water-tube boilers was included, while in the sixth the question of maintenance of such boilers was dealt with. The present edition, which is the seventh, has a useful addition by the introduction of some useful notes on oil fuel based on the results which have recently been obtained. This particular section deals with the flash point, the composition and calorific value of oil fuel, as well as the methods of stowing and burning same. Information is given as to the testing of oil fuel heaters in order to detect leaks, and also the procedure for ascertaining the condition of the filters. Although the treatment in the various cases may differ from that which experience in other directions has been shown to be desirable, this does not detract from the book in any way, but on the contrary may lead to an inductive train of thought in the reader as to the difference of cause and effect in the different cases. We know of no more complete treatise on the subject than this book, and feel sure that its value will be appreciated in the future to an even greater extent than in the past.

Testing Materials. By C. A. M. Smith, M.Sc. 6s. nett. London: Messrs. Constable & Co., Ltd.

THIS is essentially a book for students of colleges, though the author expresses the hope that some portion may be of service to engineers engaged in practice, to interest them in experimental work. The experience gained in four colleges, and a works' testing department, has led the author to believe that the great importance of experimental work is not sufficiently recognised. The arrangement of experiments in this work is of a general description, and it is pointed out that each instructor is the best judge of what suits the plant and the students, though in Chapter XII. a list of experiments is given, which may be found useful to those who are commencing to organise a laboratory course. The illustrations have been specially made for the purposes of the book, in order that the details of the apparatus may be made clear to the readers. After the opening upon the general properties of materials, the following chapters deal principally with machines for testing materials under tension and compression and further many strain measuring instruments are illustrated. Photographs of the actual form of the fractures of wrought iron and mild steel in tension, and the fractures of cast iron under compression are included and also illustrations of the fracture of cast iron specimens in pure torsion. An excellent chapter on torsion testing is given, which gives diagrams of the ultimate torsion tests of many distinctive bodies up to breakdown. The testing of timber is not neglected, there being many tabulated results applicable to almost any sample of timber. In the appendices there are included discussions upon research subjects, which are well fitted for the attention of advanced students.

Electric Wiring, Fittings, Switches, and Lamps. By W. Perren Maycock, M.I.E.E. 6s. nett. 4th edition. London: Whittaker & Co.

THIS work is especially of use for those who are actually engaged in electrical work, but it is also excellent reading both for the student and for the general reader who wishes to gain some knowledge of the subject. The volume opens with a definition of how a current of electricity is formed, and this is followed by details of switches and fuses, taking up the arrangement of "three wire" and "double three wire" services. Then comes the transformer and its method of action, and finishes with excellent diagrams of "automatic transformer switches," and the battery charging booster. A full chapter is given to lamps with their small switches, ceiling roses, and plug connections, whilst their circuits are definitely explained. The Nernst lamp and the mercury vapour arc lamps are well explained and illustrated. An excellent chapter upon signs, heaters, motors, and wiring systems is given, showing all the heater systems with excellent diagrams of these devices and finishing up with a full description of "heavily armoured" and "twin flexible" wirings. The volume finishes with a full description of bell, telephone, alarm, and clock circuits, and finally with tests, the whole work forming a most excellent text book.

The Pocket Book of Refrigeration and Ice Making.—By A. J. Wallis-Tayler. 3s. 6d. nett. 1911. London: Crosby Lockwood & Son.

THIS is the fifth edition of the work which was initially published in 1902, when the progress in the development of the particular subject was in a fairly advanced state, and it is distinctly interesting to note that the utility of the work has been appreciated to such an extent as to warrant the issue of a fifth edition of an enlarged character. This edition has been revised and brought up to date, and in addition to the inclusion of a considerable amount of most useful matter there are a number of fresh illustrations. The general heads under which the subject has been treated may be summarised as follows: Refrigeration in general; cold storage; ice making and storing ice; insulation; testing and management of refrigerating machinery and general memoranda; tables and other matter appertaining to the subject. So important has this subject become that there is a considerable amount of specialization undertaken, and in some countries diplomas are issued to properly qualified candidates for successfully passing an examination, and in this direction the book is particularly useful to intending candidates. As a pocket book to users of refrigerating plant it is, of course, of the greatest possible value having regard to its comprehensive character.

The Naval Annual, 1911. Edited by the Hon. T. A. Brassey. Portsmouth: J. Griffin & Co. 12s. 6d. nett.

THIS is the twenty-fifth issue of what has always been the leading yearly publication dealing with the navies of the world. It marks no departure either in form or policy from its predecessors, the main features being again in the hands of the same contributors that have for many years past co-operated with Mr. Brassey to make the Naval Annual not only a trustworthy source of information and work of reference about warships, but an impartial

and reliable guide of naval and public opinion. This latter function is fulfilled by the articles in Part I., which deal on this occasion with German Naval Administration, the Tactics of Trafalgar, the progress of the "Dreadnought Era," Mercantile Auxiliaries, and with the Declaration of London. Mr. John Leyland, who writes upon the first-named topic, has given an admirable exposition of the principles of administration which have had such a striking result in the creation of the new German Navy. The chapter on Trafalgar Tactics, by Mr. J. R. Thursfield, is in the nature of a reply to another historian, Mr. Julian Corbett, with whose views Mr. Thursfield is "diametrically at variance," while in that on "The Dreadnought Era: A Period of Naval Progress," Commander C. N. Robinson describes the evolution of warship types since the Dreadnought was designed, remarking that "there will be quite as much difference between the King George V. and the original Dreadnought, with only five years between them, as between the King Edward VII. and the Royal Sovereign, although nearly three times that period elapsed between the dates upon which these two latter vessels were laid down." "Mercantile Auxiliaries" is the title of a short paper by Lord Brassey which is of moment in view of the likelihood of the Declaration of London being ratified. Upon this latter important question, the Annual has two articles. In the first, Admiral Sir Cyprian Bridge shows how the Declaration concerns the Navy. He points out what is frequently overlooked, that the Declaration deals with questions that may arise, not between two belligerent Powers, but between a belligerent on the one hand and a neutral on the other. The other article, by Mr. Leyland, is more of the character of an analysis of certain provisions of the Declaration, and equally with that of Sir Cyprian Bridge it will be found of value by all. Lastly, there is the usual chapter on marine engineering from the pen of Mr. Alexander Richardson, this year entitled "Oil Engines *versus* Steam Engines." The information contained in this chapter is very full and up-to-date. The statement made by the writer that the Admiralty are considering a proposal to fit an old 20-knot cruiser of the Latona class with a Vickers heavy oil engine of considerable power, with an air compressor to supply air for manœuvring and for assisting the engine to reverse, is significant. The intention is apparently to fit such an engine in place of one of the twin steam engines, and thus to enable a thorough trial of the two systems to be made in one vessel. In Part III., devoted to Armour and Ordnance, an account is given of the progress made in the application of the Simpson weld to armour plate manufacture, and there are also the ballistics of the new 13.5 in. and 14 in. guns under construction, while some important particulars of trials in foreign countries have been brought together. The statistical tables in Part II. of British and foreign warships, with the plans by Mr. Barnaby, and the illustrations by Mr. W. F. Mitchell, call for little notice, but they also help to make the Naval Annual an indispensable work for all who have to do with the Navy and naval affairs.

CITY ENGINEERING ACADEMY.—The old students of the City Engineering Academy, 4 and 5, Aldgate High Street, London, City, will be pleased to hear that the principal, Mr. A. E. Battle, again scored well with his students at the extra examination, securing two out of the total three London passes. Mr. Battle had also notice of the appointment of one of his students as Board of Trade surveyor as a result of the examination held this year. The two results coming so close together is certainly very gratifying to all concerned, and speaks well for the maintenance of efficiency at that institution.

THE LASTING POWER OF DRIVING BELTS.—Those who have suffered stoppage of their machinery owing to the failure of a driving belt know by irritating experience the value of having a reliable material with good lasting properties. It was noted in a previous issue that the Dermatine Co., Camberwell, London, S.E., gave special attention to the manufacture of belts, and as a proof of their success in this speciality pointed to a belt in their works which had been in use for nearly thirty years. This was the main driving belt in their factory at Camberwell, and it has now been replaced after all these years of active service. The new belt is of the same standard material, two feet wide, the length being fully 100 feet.

Industrial and Trade Notes.

THE CLYDE AND SCOTLAND.

(From our Own Correspondent.)

Record Anchor Liner.—The well-known shipbuilding and engineering firm of Messrs. D. & W. Henderson & Co., Ltd., of Meadowside, Partick (formerly and for many years occupied by Messrs. Tod & Macgregor, who in shipbuilding annals have been called "the fathers of iron shipbuilding on the Clyde"), on May 27th launched their record vessel as to size; and provided their good customers, the Anchor Line, with their largest and finest Atlantic passenger ship. This was the twin-screw 10,500 ton steamship *Cameronia*, the last of a quartette of similar express passenger steamers running between Glasgow and New York. The vessel will be found described in our Launch columns.

Speed Trials of New Vessels.—The Clyde measured mile, off Skelmorlie, has formed the arena of extra activity in speed and other trials of naval ships for the past month or six weeks. Torpedo destroyers produced both by Clyde and other British builders, have been much in evidence, including the H.M.S. *Brisk*, built by Messrs. John Brown & Co., Clydebank. In the neighbourhood of the "mile" and over wider stretches of the Firth, larger naval units, in the shape of H.M. armoured cruiser *Falmouth*, built by Messrs. Wm. Beardmore & Co., Ltd., Dalmuir, and the Greenock-built Dreadnought, *Colossus*, have also been trying their paces. On Saturday, 10th June, the *Falmouth* was boarded by a navigating party from the South of England and proceeded down the Firth for a thirty-hours' continuous steaming trial at various speeds, including the contractors' twenty-four hours' continuous steaming trial. On her return, she proceeded, on June 15th, on her eight-hours' full-power steering and circling trials; and is now in her builders' wet dock for finishing touches.

New Contracts.—The London and Glasgow Shipbuilding and Engineering Co., Govan, have been entrusted by the Admiralty with the contract to build and engine a new destroyer depot ship. The vessel is understood to be pretty much like the *Maidstone*, which is being built by Scott's Shipbuilding and Engineering Co., Greenock, to attend on submarines. The new vessel is to displace 3,600 tons at load draught, and she will have propelling machinery of 2,800 i.h.p. Like all the fleet auxiliaries being constructed for the Royal Navy, the London and Glasgow Co.'s ship is to be built to Lloyd's rules, a fact which applies not only to this new ship, but to the *Maidstone* at Greenock, the *Adamant* and *Electro* at Birkenhead, the surveying ship at Barrow, and the *Watchful* and several steam trawlers at Aberdeen.

The Fairfield Shipbuilding and Engineering Co., Govan, have also received from the Admiralty the contract for a medium-sized vessel which will go towards still further augmenting the fleet auxiliaries above mentioned. This vessel, although not costing very much, as Admiralty contracts go, will, it is believed, be of a very interesting character and will be specially equipped for surveying purposes.

Messrs. Mackie & Thomson, Govan, about the end of May received contracts to build four steamers of fair size—two for foreign owners and one for Colonial owners, and also a single-screw steamer for the General Steam Navigation Co., London.

Messrs. Ritchie, Graham & Milne, Whiteinch, amongst other orders lately received, are proceeding with one for a steel barge of extra strength of structure intended to carry cargo, in pieces of 130 tons each. This craft is to the order of a British firm.

Messrs. John Brown & Co., Ltd., Clydebank, from whose stocks a splendid addition to the Orient Line fleet—the *Orama* of 10,000 tons—was sent off on June 27th, are engaged fitting out two fine steamers—the *Argyleshire* and the *Shropshire*—for the Federal Steam Navigation Co., London. These vessels, which are each of 11,000 tons, are to be employed in the Australian meat trade, and have very extensive and specially fitted accommodation and refrigerating plant for this purpose. The first to be completed—the *Argyleshire*, will proceed on trial shortly.

Messrs. Fleming & Ferguson, Paisley, have received from the Tyne Improvement Commission a contract for a non-propelling, centre-ladder, barge-loading dredger. The dredger will be capable of dredging in stiff clay to a maximum of 45 ft. below water level at a rate of not less than 200 tons per hour, and at the same depth at a rate of not less than 400 tons per hour when working in sand or mud. The vessel will be used in connection with the deepening and widening of the river Tyne.

The Clyde Shipbuilding and Engineering Co., Ltd., Port Glasgow, are at present lengthening the Elder-Dempster liner, *Muraji*, which was built by them in 1904. She is having about 30 ft. added to her present length of 350 ft. The work is expected to occupy from six to eight weeks.

Messrs. Wm. Denny & Bros., Dumbarton, early in June—following upon the departure from their tidal dock of the new Channel turbine-steamer *Riviera*—launched from the stocks the twin-screw steamer *Remuera* for the New Zealand Shipping Co., of London. In the one case the vessel represents the speediest passenger steamer yet built by the firm, and in the other the largest and heaviest ever launched into the waters of the Leven.

Messrs. Murdoch & Murray, Port Glasgow, about the end of May, obtained a contract to build a steamer for service on the river Amazon. The vessel will be fitted for passengers and cargo, and will be one of the largest yet built for the Amazon service. Triple-expansion engines will be supplied by a Glasgow firm.

The Greenock and Grangemouth Dockyard Co., about the end of May, contracted to build for Australian owners two steamers each 350 ft. in length and capable of carrying 6,600 tons, the engines for which will be supplied by a Greenock engineering firm. These, together with other orders, booked earlier in May, increase the work in hand by about 20,000 tons.

The Ailsa Shipbuilding Co., Troon, have received an order from the Clyde Trustees for a new paddle tug at the price of £10,970 to take the place of the Trusts' well-known paddle tug *Clyde*, which, after over fifty years' service, is about to be put on the retired list.

Messrs. Alley & McLellan, Polmadie, have booked orders for a paddle barge of 20 tons and a steel cargo lighter of 500 tons, both for foreign owners.

Irvine Shipyard.—The ground on which Irvine shipyard formerly stood has been purchased for clients by Messrs. Biggart, Lumsden & Co., solicitors, Glasgow. The clients are prominently associated with shipping and shipbuilding, and on the ground acquired it is intended to lay out a shipyard with up-to-date features for the building of medium-sized ships. The yard and launching facilities, it is stated, are capable of being extended at comparatively little trouble, for the purpose of building and launching vessels up to 300 ft. long.

Fairfield Crane and Sheer-legs.—The Fairfield Shipbuilding and Engineering Co., Ltd., Govan, whose new 200-ton hammerhead crane, which was built by Sir Wm. Arrol & Co., is now fully available, are disposing of their old sheer-legs, the dismantling of which was the first real work done by the new mammoth appliance. The sheer-legs have done good work in their day, putting the engines and boilers into many notable ships, but they are not the least bit the worse of the many years' wear, and far too good to scrap. They have been made into sections and packed up for shipment to a smaller yard at Sorel on the St. Lawrence, where they will be re-erected and begin a new lease of life.

Dock Pumping Machinery.—Messrs. Drysdale & Co., Bon-Accord Works, Yoker, are supplying to the Wick Harbour Trustees, for the new graving dock being constructed there, a steam engine and centrifugal pump at a cost of £511. Operations at the dock are practically awaiting the installation of the pumping machinery, and this will be supplied with despatch. The contract to supply pumping and hydraulic machinery required at Rosyth Naval Base has been secured by Messrs. Fullerton, Hodgart & Barclay, engineers, Paisley.

Clyde Graving Docks.—Exhaustive repairs to the older of the two graving docks at Troon have just been completed by the Glasgow and South-Western Railway Co., who are responsible for the maintenance of the harbour facilities at this old Ayrshire port. New dock gates of steel construction have been substituted for the old wooden gates, and this work has been carried out by Sir Wm. Arrol & Co., Glasgow, while the rock excavation and concrete work have been in the hands of the railway company's own workmen. This old dock at Troon, and the still older dock at Port Glasgow—the dates of construction being 1810-12 and 1817 respectively—were long the largest graving docks in the West of Scotland, and prior to the opening of a first graving dock at Glasgow Harbour by the Clyde Trustees in 1875 were often requisitioned by Glasgow and Greenock shipowners for repairs to their largest vessels. The subsequent construction of larger docks by the Clyde Trustees in 1886 and in 1898 as well as private docks even earlier by Messrs. Tod & Macgregor, at Partick, Scott & Co., Greenock, and Caird & Co., Greenock, rendered it unnecessary for vessels trading to Glasgow to go so far afield as Troon for overhaul and repair. Now, with all the facilities of this kind in existence on the Clyde and the West Coast of Scotland, there seems to be no plethora of graving docks, and the need that has long been felt for a dock of immensely greater capacity than at present existing is about to be provided for by the Clyde Trustees at Renfrew.

THE TEES AND HARTLEPOOLS.

(From our Own Correspondent.)

Whitby.

Messrs. Suggit, Forth & Co. have recently sold the s.s. *Vera* of 2,391 gross tons and 3,700 deadweight to Messrs. Arthur Richter & Co., Baltic Chambers, Newcastle-on-Tyne, for about £9,000, through Messrs. Shaw & Co., Quayside, Newcastle.

Middlesbrough.

Messrs. Sir Raylton Dixon & Co., Cleveland Dockyard, still continue to be busy, and are reported to be likely to secure an order to build a medium-sized cargo and passenger steamer.

Messrs. W. Harkess & Co., Ltd., have just converted their business into a public limited company, to enable them to buy up the land on which their shipyard stands. They have a good name for the smaller-sized steamers, and expect to be busy for some months to come.

Messrs. Richardsons, Westgarth & Co., Ltd., maintain a good output of work, and are reported to have secured a contract for foreign owners, but enquiries are falling off somewhat.

Messrs. Smith's Dry Dock Co. continue to be busy in all departments, both on new and old work, all berths being taken up.

Stockton and Thornaby.

Messrs. Richardson, Duck & Co. are fairly busy, but nothing is reported during the month, though they expect to book an order that is in the market.

Messrs. Craig, Taylor & Co. keep fairly busy, having recently launched the s.s. *Mary Baird*, a fine cargo steamer for Messrs. Baird & Co., West Hartlepool. They are preparing to lay down another in the vacated berth.

Messrs. R. Ropner & Sons are busy, but not to the extent they would like, competition remaining keen and prices low. They are reported to expect to secure an order for foreign account.

Messrs. Blair & Co. still maintain a very busy aspect in all departments, having as much work on hand as they can cope with at present, and are reported to be well booked ahead.

West Hartlepool.

Messrs. W. Gray & Co. continue to be very busy; amongst the orders recently booked is a cargo steamer for The Trechman Steamship Co., West Hartlepool. They are reported to be well booked ahead, except for the smaller class of steamers.

Messrs. Irvine's Shipbuilding & Dry Dock Co., Harbour Dockyard, continue very busy on old and new work. They are reported to have secured the contract to build a small steamer for a Dutch firm.

The Central Marine Engine Works of Messrs. W. Gray and Co. continue to be very busy in all departments, including specialities, and have all the steamers to engine that are building at their old and central shipyards, being booked up for nearly a year ahead.

Hartlepool.

Messrs. Irvine's Shipbuilding & Dry Dock Co., Middleton Yard, are very busy. Good progress is being made with a large twin-screw steamer building for Messrs. W. Esplen and Sons, Liverpool, for the meat trade. They are also reported to be likely to book an order for two cargo steamers that are said to be for the Transport Co., Liverpool.

Messrs. Richardsons, Westgarth & Co., Ltd., continue to be fairly busy. They have a considerable amount of work on hand, good progress being made with their "Contraflo" condenser, also their new type of radial evaporator. They are reported to have secured the order to supply the machinery for two steamers to be built by Messrs. Irvine's Shipbuilding & Dry Dock Co., and are also busy with several large condensing plant installations.

THE HUMBER AND DISTRICT.

(From our Own Correspondent.)

NOTWITHSTANDING the strike organized by the Seamen and Firemens' Union, the Coasting and Continental services of steamers using the Humber ports, including Grimsby, Hull and Goole, are still in full swing, and all steamers get crews as required without trouble.

The Wilson Line have had launched for them at Port Glasgow on the Clyde, by the Clyde Shipbuilding Co., a new cargo-boat called the *Erato*, for the Mediterranean trade. She is of the following dimensions :—300 ft. by 43 ft. by 20 ft. 6 in. m.d. She will carry 3,700 tons d.w. and will be fitted with triple-expansion engines to give a speed of 10 knots loaded. The engines have been built by the Clyde Shipbuilding Co. The Wilson liner *Eskimo* has been chartered for the naval review.

Messrs. Earle's Shipbuilding & Engineering Co., Ltd., have been successful in booking another order from the Wilson Line, of Hull, for a new steamer for the Baltic trade, to run between Hull and St. Petersburg. She is to be a fairly large steamer, 310 ft. in length, and high speed, and to be fitted for first-class passengers, and holds to be insulated for carrying perishable goods, such as butter, poultry, etc. Refrigerator chambers for cabin stores will be provided. She will be a similar steamer to the s.s. *Kovno* class. The s.s. *Cromer*, of the Great Eastern Railway Co., is now undergoing her annual overhaul, opening out machinery, boilers, etc., to pass Board of Trade Survey. She will be cleaned, painted and redecorated before taking up her work at Harwich. The s.s. *Immingham*, of the Great Central Railway Co., is nearly finished, the turbine machinery has been taken out of her and she is now fitted with triple-expansion engines, and expected to have a fairly good sea-speed. The alterations have been extensive. The s.s. *Marylebone* will, in a few days, undergo the same alterations as the s.s. *Immingham*. The s.t. *Alprich*, French trawler built by this firm eleven years ago, is now undergoing extensive repairs, also having a new boiler fitted. The outside staff keep fairly well employed on different steamers in the various docks, and the patent slips have been well booked up.

Messrs. Stewart & Craig, engineers and boilermakers, have had a busy month, and numerous contracts have been fixed. Prospects are good.

North-East Coast Engineering Works, Ltd., are keeping fairly busy, and during the last month, work has been done on the following steamers :—The s.s. *Queenie*, s.s. *Lammington*, s.s. *Fox*, s.s. *Regina*, s.s. *Floristor*, s.s. *Olof*, and the tugs. *Linesman*, *Powerful* and *Winchester*. The s.s. *Queenie* and s.s. *Lammington* have both been in dry dock, and heavy repairs executed.

Messrs. Cooper & Co., Ltd., engineers and boilermakers, Neptune Engine Works, have had a heavy month of repairs and dry-dock work. The s.s. *Mistley* has been lengthened by 16 ft. 4 in., and other repairs have been executed on her which will cost a considerable sum. The repair work outside has greatly increased, and the Company's graving dock has been employed with coasting and other small steamers. The branch shop at Alexandra Dock is keeping busy with outside work, opening out for Surveys, dry-docking of steamers, etc. The moulding shop at the works is very busy with [illegible] for propellers and other work.

Fish Dock or St. Andrew's Dock.—The repairing shops around this particular dock are very busy opening out boilers and machinery for Lloyd's Survey, and the patent slip belonging to the North-Eastern Railway Co. is well engaged with trawlers, etc.

Hull Central Dry Dock & Engineering Works, Ltd.—This Company always have an abundance of work, and the staff at all times are taxed to the utmost. The following steamers have been in the firm's own dock and in the docks belonging to the N.E.Ry. Co. and H. & B. Ry. Co., which the Company have been compelled to engage :—s.s. *Algores*, s.s. *Danmark*, s.s. *Monica*, s.s. *Skandia*, s.s. *Rodney*, s.s. *Elisabeth*, s.s. *Argus*, s.s. *Tangermuldul*, s.s. *Antwerp City*, s.s. *Dalecrest*, s.s. *Fredheim*, s.s. *Atlantic*, s.s. *Muril Coverdale*, s.s. *Aridane*, s.s. *Aridane Christine*, s.s. *Holgate*, etc. They have now on hand several heavy repair jobs.

Messrs. Amos & Smith, Ltd., engineers and boilermakers, Albert Dock Works, are still working night and day, to compete with the many orders they have in hand for boilers and machinery which they have been entrusted with. In many cases they cannot give delivery this year. They have booked several orders lately for next year delivery. The outside staff is very busy on repair work and opening out for Board of Trade, Lloyd's and British Corporation Surveys. The branch shop at Alexandra Dock is keeping fairly busy on repair and dry dock work. They have booked several steamers for dry-dock use.

Messrs. Woodall & Co., engineers and boilermakers, have been fairly employed on the following steamers in the various docks, overhauling engines and boilers and deck-work :—s.s. *Gustaf Adolph*, s.s. *Jagerslong*, s.s. *Holm*, s.s. *Jelling*, s.s. *Rask*, s.s. *Trigg*, s.s. *Heim*, s.s. *Adolph*, s.s. *Chance*, s.s. *Hild*. The works are also fully employed executing orders for home and foreign export, of their patent Handibloc, which is coming into great use in ships and warehouses. The smiths' shop is fully employed with orders for forgings for the different Railway Companies. Prospects are good.

Messrs. Cochrane & Sons, shipbuilders, Selby, are still booking orders for trawlers and drifters and other small coasting-steamers for local and other owners. In many cases they cannot guarantee delivery this year. Several of the departments of the yard keep working overtime to compete for delivery of same.

SOUTH OF ENGLAND AND ISLE OF WIGHT.

(From our Own Correspondent.)

THE widening of the Trafalgar Dry Dock in order to provide sufficient accommodation for vessels of the *Olympic* class is rapidly proceeding. The dock was opened in 1905 and was then amply large enough to take any vessel afloat. The following figures show the original dimensions and the size the dock will be after the alterations : Length overall before, 875 ft. ; after, 897 ft. Width at entrance before, 90 ft. ; after, 100 ft. Width inside at lowest altars before, 90 ft. ; after, 102 ft. Width inside at cope before, 125 ft. ; after, 125 ft. Depth over cill H.W.O.S.T. before, 33 ft. ; after, 35 ft. Depth over blocks before, 33 ft. 6 in. ; after, 33 ft. or more if required. (Depth H.W.N.T. about 3½ ft. less). The entrance gates are being removed and replaced by a caisson. Means are provided by which it will be possible to maintain or increase the level of the water in the dock whilst the tide is falling outside and a new range of cast-iron keel blocks is being fitted. Previously ships have been docked at high tide only, and this has been satisfactorily completed, due to the long period of high water. The old dock gates provided for shutting out the water only, but the caisson is double faced and capable of holding the water level within the dock with a falling tide outside. Prior to the reception of the *Olympic* a distinguished party made a tour of inspection of the work in progress at the dock under the direction of Mr. T. M. Williams, docks and marine manager, and the engineering staff.

The Cunard Co.'s new liner *Ascania* sailed from Southampton on the 23rd of May on her maiden voyage to Canada, in connection with the new fortnightly service which the Company have inaugurated. The Mayor and a distinguished company were present at a luncheon aboard the vessel, when

he guaranteed that every facility would be afforded in connection with the new service, especially in that branch of it relating to dairy produce from Canada, for which the vessel is thoroughly equipped. Southampton possesses one of the largest cold stores in the United Kingdom, and, moreover, is favourably situated as a distributing centre, and it is anticipated that a large trade in Canadian dairy produce will shortly be conducted from the port.

The *Olympic* sailed on her maiden voyage to New York on the 14th of last month in accordance with the Co.'s time table, although at one time it was extremely doubtful if this would be accomplished owing to the coal porters' strike, which the seamen and firemen also joined. After several meetings with the employers the "coalies'" grievances were settled and the men returned to work. The White Star Co. later granted concessions to their men, so that the liner was enabled to sail as advertised.

Messrs. J. Samuel White & Co., East Cowes.—H.M. torpedo-boat destroyer *Forester*, second of this class for the 1910 programme, was launched on the 1st of last month, and has received her machinery; also work on the sister vessel, the *Ferret*, is proceeding briskly.

Messrs. J. I. Thornycroft & Co., Ltd., Woolston Works, Southampton.—The following British Admiralty work is in hand at the above works. H.M.S. *Acheron*.—This vessel was launched on the 27th June with masts and rigging, etc., and is now completing fitting out. H.M.S. *Ariel*.—Good progress is being made on this vessel, which is closely following the *Acheron*. Armoured Motor Patrol Boats.—Two of these boats have been shipped after satisfactory trials, and good progress is being made with the twenty-one other boats to this order. Repair and General Work.—This department has been well employed during the past month. Amongst the vessels in hand for repairs were the s.s. *Prince Leopold de Belgique*, *Commercial*, *Rohilla*, *Eveline* (Dredger Walter Bibby), and steam yachts *Christine* and *Miranda*.

Messrs. Day, Summers & Co., Ltd., Northam Ironworks, Southampton.—The paddle steamer *Princess Mary*, designed and built by the above firm to the order of the Southampton, Isle of Wight, and South of England R.M.S.P. Co., Ltd., completed a very satisfactory trial trip, and was taken over by the Company about the middle of last month. The dimensions of the vessel are—Length, 195 ft.; breadth, 24 ft.; depth moulded, 8 ft. 3 in. The machinery indicates 1,000 horse-power and a maximum speed of 15·8 knots was obtained. The vessel has several notable features, one being the large windows alongside the alleyway on each side of the main saloon, which can be opened or closed as required. On trial the engines worked with great smoothness, there being a notable absence of vibration. The boiler is exceptionally large and supplied ample steam. The vessel ran her maiden trip in the Company's service on the 17th of June. Last month a large number of yachts passed through the hands of the firm in preparation for the Coronation Review, among which were the *Medusa*, *Vanduara*, *Albion* and *Gelert*.

THAMES.

(*From our Own Correspondent.*)

Companies' Meetings.—At the Union Castle Company's meeting there was a balance shown of £72,040, and a dividend of 6/- per share was declared, making a total of 5 per cent. on the ordinary shares and leaving £29,488 to be carried forward. The Company has three new boats on order, to be named *Galway Castle*, *Gloucester Castle* and *Guildford Castle*. The firm of Messrs. Elder, Dempster & Co. has held its first annual meeting under Sir Owen Philipps, and a profit is shown of £228,000. It was stated an order had been placed for two express mail and passenger boats for the West African service, while a new type of cargo-boat is being built also. A dividend of 6 per cent. was declared, and, together with 2 per cent. on the ordinary shares, 8 per cent. was paid on the management shares. Among cognate Companies we find the report of the "Shell" Transport Trading Co., with a final dividend of 2/6 per share, making 22½ per cent. for the year. This is from an available balance for the year of £599,821, leaving £287,321 to be carried forward. The Thames Ironworks & Shipbuilding Co. has held its twelfth annual meeting, and it was stated by the chairman that orders had been received for three new boats for the Turkish Government. The Company are proposing a debenture issue of £300,000, and continues very busy, especially in the motor department. A London firm that has done well is Waygood and Co., who have had the order for lifts for the *Titanic* and *Olympic*. For the North German Lloyd Co. the firm has fitted lifts after the vessels were in service, which is said to have been a difficult operation to execute.

Trinity House.—The Master of the Corporation for the ensuing year is the Duke of Connaught, and Capt. H. Acton-Blake is the Deputy Master, the members, after the meeting, proceeding on Trinity Monday to a service at St. Olave's, Hart Street, where the sermon was preached by the Bishop of London.

St. Paul's Bridge.—This great project, of which so much has been heard lately, has not passed the House of Commons. The opposition of the architects relating to the proposal as regards St. Paul's Cathedral has been too strong. They ask that the road from the bridge should lead up to the Cathedral face instead of passing by the east side, and on this point the project has been defeated.

New Railway for the Docks.—A large proposal which has been before the public for some time, *viz.*, to construct an outer London railway from Feltham to the Docks, connecting several lines *en route* has been partly successful, and as it emerges from the Committee-rooms of the House of Commons will extend from Northolt to the Victoria and Albert Docks, the part referring to Tilbury being struck out, also that to Feltham. Even on this basis it will be a large matter, the length being nearly 50 miles in a circular direction. The railways affected will be the Great Western, Great Central, North-Western, Midland and Great Northern, which will all be connected to the new line.

Greenwich Observatory.—The annual visitation by the Board of Visitors to this Institution has taken place recently. The Astronomer Royal, Mr. F. W. Dyson, presented the report, in which it was stated that since the increase of electric motors on board H.M. ships, chronometers had differed somewhat and experiments were taking place to find out the position as regards the disturbed area at which chronometers could safely be placed. The experiments were continuing.

Sea Training.—The *Medway*, the four-masted barque, has returned to the S.W. India Dock after making her first round-the-world voyage as a training ship. She sailed in August last with thirty cadets on board, and began her homeward trip on February 8th, which took ninety-seven days from Australia. The vessel belongs to Messrs. Devitt and Moore's Ocean Training Ships, Ltd. The *Exmouth*, the training ship on the Thames, was inspected by the members of the Metropolitan Asylum Board recently, the Chairman of the Royal Mail Co., Sir Owen Phillips, being present. Of the 300 boys discharged during 1910, 73 entered the Navy, and 165 the mercantile marine.

Yachting.—This is the season for the Thames regattas, an important one being that from the Nore to Dover under the Royal Thames Yacht Club, the *Norada*, a new boat, being the winner in the 19-metre class. There were races for 15-metre boats and a handicap for yachts from 35 to 75 tons over the same course. Another race by the Club was over a river course of 49 miles, out and home, finishing at Gravesend.

MERSEY AND MANCHESTER SHIP CANAL.

(*From our Own Correspondent.*)

THE special feature of the month has been the arrival in the Mersey of the *Olympic*, which aroused much interest. Her arrival in the river was the occasion of much whistle-blowing, etc., and during the following day many visitors paid 2/6 admission, the proceeds being devoted to the local charities. In this connection and also with reference to the new Cunarder *Aquitania*, it is of interest to note the steps that have to be taken by a port such as Liverpool to retain its pre-eminence, the huge Gladstone Docks under construction, the immense dry and wet dock system, the powerful fleet of dredgers, embracing the *Leviathan* and *Coronation*, the important salvage plant, and facilities for heavy repair work second to none in the Kingdom. The

port's fame as a shipbuilding centre is also growing, while this industry is increasing on the Dee.

Messrs. Cammell, Laird & Co.—All the departments of these works continue to be very busy with the current orders, while a fair amount of new work is also being booked, enquiries being fairly plentiful. The entire staff now being centred in one large building, the facilities for dealing with the large amount of work are further increased. On June 10th the *Chenab* was launched at the Tranmere Yard for the Nourse Line. This vessel will be specially fitted for the Calcutta trade and has now completed shipping of her engines and boilers ready for trial. The *Highland Piper* is lying in the wet basin and is due to take up her sailings very shortly, being one of a fleet of ten new steamers recently put on by the Nelson Line. The *Francisco Salles*, stern wheeler, which recently left in tow for Para, has given the owners such satisfaction that they have placed an order for a similar vessel with Messrs. Cammell, Laird & Co. The *Lapwing* and *Lizard*, destroyers, also the tenders *Adamant* and *Alecto* are now ready for launch, while the "Dreadnought" and cruiser, also the floating dock, are making good headway. Work is being pushed forward on the Cross Channel steamer for the Holyhead to Ireland service of the L. & N.W.Rly. New boilers are being fitted to the *City of Belfast*, while the four-master *Cawdor* has had her yards removed and other alterations, preparatory to being towed to Spain for use as a coal hulk. The Norwegian whaling steamer *Bucentaur* has been in dry dock for extensive repairs and survey, this requiring the removal of the sperm oil tanks. Mr. T. H. Blaker, who has been with Messrs. Cammell, Laird & Co. for ten years, left on June 17th to take up the position of manager of the shipyard of Messrs. Day, Summers & Co., Southampton. Mr. Blaker, who has acted as manager of the small-work department was originally with the firm of Messrs. John Jones & Co., later the Tranmere Company, and which is now absorbed in the firm of Messrs. Cammell, Laird & Co. The Secretary, Mr. J. W. P. Laird, presented Mr. Blaker with a cabinet of cutlery in the Board Room on behalf of the firm and staff, while a solid silver cigar case was similarly presented by Mr. John Watson, chief draughtsman, on behalf of the engineering staff.

Messrs. Clover, Clayton & Co.— This firm have recently had a steady run of work, and this continues unabated. The repairs and enlargements to the dry docks and the installation of larger pumping machinery is now nearing completion, thus giving this firm increased facilities. The Midland Railway Co.'s steamers *Manxman*, *Antrim*, *Donegal* and *Duchess of Devonshire* have been in for extensive overhaul and survey. Various other contracts have kept all their berths busy.

Messrs. H. & C. Grayson.—This firm have had, besides their usual repair and survey work, several important and interesting contracts. The Pacific Steam Navigation Co.'s tug was launched on May 27th and is now fitting out. The training brig *Jas. J. Bibby* has been in for repairs due to collision on the night of the 30th May in the Mersey with the *St. Elvies*, when the former was beached. Messrs. Grayson effected temporary repairs, afterwards bringing the *Bibby* into dry dock. The *Bibby* left on June 10th with a complement of forty boys for the Coronation Review at Spithead.

The Liverpool Salvage Association.—For some time past this Company have been contemplating the establishing of a depot at Holyhead. A site has now been secured and equipped with a complete plant. This Company's steamer *Ranger* is now taking part in the salving of the *Ivernia*, after which she will take up her station at Holyhead. This station will serve the west coast of England and Scotland, also Ireland, and it is considered that with a steamer ready to leave at a moment's notice the mouth of the Mersey could be reached quicker than from Liverpool, due to time lost in undocking. A similar station is likely to be established in the English Channel shortly.

School Ship "Conway."—The 52nd annual meeting of the subscribers was held in Liverpool on the 15th June. During the year 101 cadets joined and 103 left. The total number of cadets who had joined from 1859 to 1910 was 4,250, 2,909 having entered the mercantile marine, 106 the Royal Navy, and 386 the Royal Naval Reserve as midshipmen.

The "Nimrod."—This vessel has been laid up at Birkenhead since Sir E. Shackleton's expedition. She has been purchased by a Captain Webster, who is making a special voyage to the Yenisei River, in Siberia. He will be accompanied by his wife, a Russian lady. The vessel has had a thorough refit in the Salthouse Dock and leaves at the end of June.

The Cunard Line.—The *Mauretania* arrived in Liverpool on May 30th, having completed her 100th trip. It is of interest to note that this vessel began her career 3½ years ago. Her highest day's run westward is 676 and eastward 614 miles. Best average speed for a day's run is 27·04 and for a voyage 26·06 knots. Total mean average speed is 25.25 knots, which is 29·10 miles.

White Star Line.—This Company have lost the services of an old and faithful servant by the retirement, owing to ill-health, of Mr. Hugh Crawford Boyle, who has had over thirty years' service with the White Star Line, for twenty-one of which he has been chief engineer. Mr. Boyle served his apprenticeship with Messrs. Rankin & Blackmore, of Greenock, and obtained his two certificates while with the Leyland Line. His first White Star voyage was made in the old *Arabic*, and later he was on the old *Adriatic*, then the largest boat afloat. Mr. Boyle has been in command of the machinery of the *Cymric*, *Celtic*, *Baltic* and *Adriatic*. On his retirement Mr. Boyle received from the owners a solid silver inkstand, and from the engineers a silver salver.

The Training Ship "Indefatigable."—The committee have appointed Commander H. Butterworth, R.N., retired, to succeed the late Capt. Bremner to command the *Indefatigable*. In 1882 he joined H.M.S. *Worcester*, and after two years passed with first-class extra certificates. Having served his apprenticeship with Messrs. Shaw, Savill & Co., he then joined the British India Steam Navigation Co. Commander Butterworth left the mercantile to qualify in torpedo and gunnery. He rejoined his old company and later rejoined the Navy as lieutenant and later as navigating officer. After considerable foreign service he went to Greenwich College and passed for first-class navigating officer. For some time he was King's Harbour Master in Hong Kong, and in May, 1911, he retired from H.M.S. *Nile* with the rank of Commander.

NORTH-WEST OF ENGLAND.

(From our Own Correspondent.)

Barrow-in-Furness.—The shipbuilding industry is very briskly employed in every department of the works of Messrs. Vickers, Ltd., at Barrow. By degrees this gigantic establishment has assumed very great magnitude, as from time to time new branches have been added, or old branches have been very considerably enlarged. Take one example alone, that of the boiler shop of the firm. At one time it was a comparatively small place. It was greatly enlarged under the management of the late Mr. Bryce Douglas, but since the Vickers Co. took over the firm it has been further extended to about six or eight times its original dimensions. At present it is occupied mainly by water-tube boilers, mostly of the Yarrow type, but there are also many of the old cylindrical boilers in progress of construction. In this branch of the business there is always a deal of work incidental to gun mounting on which boilermakers are largely employed. The boiler shop at Barrow is probably the largest in the world in connection with any marine or other engineering establishment.

A Prospective New Industry.—The Vulcan Works at Barrow, which were originally built for the manufacture of railway waggons, and which were subsequently employed for the building of tubular frame railway waggons, are being pulled down and the brick and building material is being sold to ready customers. There are many millions of bricks for disposal, and all the ground, comprising some 20 acres, is to be cleared in twelve months. The site is then to be used for a new industry. It was first reported that a new department of Messrs. Vickers' works would be established here in connection with airship construction, as it is situated within very easy distance of the large airship Messrs. Vickers have built in the Cavendish Dock, but it appears that the land is required for quite a new industry for Barrow, that of producing electric motors and accessories with which the Vickers Company are already largely connected in works they have provided at Birmingham.

The Chinese Cruiser.—The Chinese cruiser, building at Barrow, is to be launched on July 14th, when a large Chinese party connected with the navy and with the Ambassador's headquarters in London will visit Barrow to see the launch [illegible] ship, but it is likely to lead to other orders, and in that sense [illegible]

The Japanese Battleship Cruiser.—Very considerable progress has been made with the work of building the Japanese battleship cruiser at Barrow, as many of the workmen hitherto engaged on the British cruiser *Princess Royal* have now been transferred to the Mikado's ship. In the first week of July the Japanese warships *Kurama* and *Toni* will proceed from Portsmouth to Barrow, where they will be docked. Admiral Togo will also visit Barrow at the same time and will inspect the new Japanese war vessel on the stocks at Messrs. Vickers' yard, as well as the *Princess Royal*, which is a smaller vessel nearing completion. It is also probable that the gallant admiral will also have the opportunity of inspecting the naval airship. At any rate, his visit will be of great interest to him, as his flagship, the *Mikasa*, was built at Barrow, as well as the *Katori*, a more recent addition to the Japanese fleet.

Floating Docks.—Work has been begun on the Montreal floating dock for the Canadian Government. It is of immense size and is very much larger than the dock recently built at Barrow for the Brazilian Government. The latter dock has been thoroughly tested at Rio de Janeiro, having lifted without a hitch the *Minas Geraes* and the *Sao Paulo*, the two "Dreadnoughts" built at Elswick and Barrow respectively. The Aberdeen dock, built at Barrow for the Commissioners of the Scotch port, is ready for delivery, but she is moored in the Buccleuch Dock at present awaiting the order for delivery, which is being delayed in consequence of the Commissioners having discovered that certain improvements in the deepening of the harbour will have to be made before the dock can ride safely at low water.

Dock Work.—Contracts have been let for the deepening of Walney Channel out to sea with the view of enabling the *Princess Royal* and other similarly large ships to get in and out of Barrow harbour. Messrs. Vickers, Ltd., have also contracted with Sir Wm. Arroll & Co., to build a deep water berth in Walney Channel where the largest vessels—warships or ocean liners—can ride with safety at dead low water. This berth will be dredged to a depth of 35 ft. at low water. It will be very useful for the docking of a large ship in an emergency, when it is perhaps impossible for her to get into the docks, and it will be a great advantage to the firm in being able to berth a vessel of even greater breadth than 100 ft., which is the width of the dock gates, and means will be provided by which vessels can be equipped with engines, boilers, etc., at this place. Very great activity is observable in the docks in the work going on in connection with the completion of the *Princess Royal*, the *Dartmouth* cruiser and a tugboat for the Canadian Government.

Hæmatites.—The hæmatite iron trade has fallen off considerably during the past few weeks, and it has been found necessary to further restrict the output of metal. Mixed Bessemer numbers are at 64s. nominal, and warrant sellers at 62s. cash.

Shipping.—There is keen depression in the shipping trade and the fall in exports of iron and steel as against last year is over 80,000 tons.

BELFAST.

(*From our Own Correspondent.*)

Messrs. Harland & Wolff.—The 31st of May was an all-important date in the annals of shipbuilding in Belfast, for on that day Messrs. Harland & Wolff dealt with the two largest vessels in the world, launching the White Star liner *Titanic* and despatching her sister ship *Olympic*. It is not necessary to give here a description of these magnificent examples of naval architecture. Of the launch of the *Titanic* it is sufficient to say that everything went off without a single hitch, the huge bulk commencing to move down the ways at the precise appointed time, whilst as regards the *Olympic*—which at the time of writing is on her maiden voyage from Southampton to New York—her performance on the informal trial trip was entirely gratifying to everybody concerned. A few days previous to this, the Queen's Island firm completed the fitting out of the two new White Star tenders, *Nomadic* and *Traffic*, which have been designed and constructed for the Company's service at Cherbourg. With reference to the statement that Messrs. Harland & Wolff are to build another vessel for Messrs. Ismay, Imrie & Co., exceeding the dimensions of the two latest additions to the fleet, it may be gathered from Lord Pirrie's recent speech at Southampton that nothing bigger than these vessels will be built by them for some little time to come, for Lord Pirrie stated that his firm had been consulted regarding the building of a bigger boat, and that he had pointed out that it would be folly to construct a vessel for which there is no existing dry-dock accommodation. It may be taken as pretty certain, however, that the White Star line will again go in for a record breaker in the matter of size so soon as the harbour authorities concerned provide the necessary accommodation. It is now many years since Lord Pirrie first maintained (in the days when a vessel 500 feet long was looked upon as a leviathan) that the day of the 1000-foot ship would surely come, and that, possibly, in his own time. There appears to be every prospect of the prediction being realized within the next few years, and that the next big graving dock to be built will probably be made to such dimensions as will take in a vessel of this length and a proportionate width. Whilst on the subject of big ships, it may be mentioned that the report that the Hamburg-America Company had placed with Messrs. Harland & Wolff the order for a steamer larger than the *Olympic* and *Titanic* is incorrect. The Belfast *Evening Telegraph* communicated with this shipping company and were informed that the vessel would be built in Germany. Messrs. Harland & Wolff have received an order for two steamers for Messrs. MacGregor, Gow & Co., but owing to their already having contracts to keep the yards in full swing for a long time to come, the building of these two steamers will be sub-let to the Tyne. In the large volume of new tonnage under construction by them are no fewer than four vessels for the Royal Mail Steam Packet Company. One of these is a triple-screw mail and passenger steamer of 14,000 tons, to be named *Arlanza*, and she will be the largest vessel sailing to South America. The other three are to be 10,500 tons each, and are intended for the company's new intermediate service to South America.

Messrs. Workman, Clark & Co.—On 1st June this firm launched a large twin-screw steamer named *Vandyck*, which they have built for Messrs. Lamport & Holt's passenger and cargo service to the Brazils and River Plate. They have at present in graving dock for repairs the new British India Steam Navigation Co.'s twin-screw boat *Egra*, which was launched by them in March. The vessel had just undergone successful speed trials on the Clyde, and when, subsequently, she was starting off for a cruise, she unfortunately struck a submerged rock in the Western Islands. A considerable length of her keel plating has been ripped open, and it will be several weeks before she is ready for sea again.

FOREIGN NOTES.

GERMANY.—GERMAN SHIPYARD DIVIDENDS.—The following is a list of the most important Shipbuilding Yards in Germany, taken from the *Marine Rundschau*, showing the dividends distributed in the years 1909 and 1910, by which it can be seen how their position compares with that of our own yards.

Bremer Vulkan, Ltd.	..	for 1909,	0%	for 1910	7½%
Blohm & Voss, Ltd.	..	,, ,,	4%	,, ,,	6%
Rickmers, Ltd.	.. ..	,, ,,	5%	,,	7½%
Reiherstieg, Ltd.	.. ..	,, ,,	7½%	,, ,,	5%
Stettin Oderwerke	.. ..	,, ,,	0%	,,	5%
Neptun	.. .. ..	,, ,,	4%	,,	0%
Nüscke	.. .. ..	,, ,,	4%	,, ,,	0%
Flensburg Co.	.. ..	,,	6%	,, ,,	0%
Seebeck & Co.	.. ..	,, ,,	4%	,,	0%
Weser, Ltd.	.. .. ..	,,	0%	,,	0%
Howaldtswerke	.. ..	,, ,,	0%	,,	0%
Janssen & Schmilinsky	.. ..	,, ,,	0%	,, ,,	0%
Henry Kock	.. .. ..	,,	0%	,, ,,	0%
Tecklenborg	.. ..	..	0%	,, ,,	0%
Vulkan, Stettin	.. ..	,, ,,	10%		11%

Most of the yards have orders in hand, which will not show in the balance sheets till this or next year. Some of the

orders are as follows:—The Hamburg-America Line with fifteen steamers, their gross register being 126,000 tons; the "Hansa" Line with eight steamers of 46,000 gross register tons; the Hamburg South American Line with seven steamers of 44,000 gross register tons, and thirty-three other steamers of various ocean lines of about 132,000 gross register tons. STEAMSHIP COMPANIES.—The earnings of the various Steamship Companies in 1910 were fairly favourable, the Hamburg America Line distributing 8%, as against 6% in the year 1909. The "Hansa" Line distributed 10%, as in 1909. The Oldenburg Portuguese Line, however, was the most successful, leading with 12% for 1910, against 10% in 1909. The dividends of the other companies fluctuate from 3 to 8%, but all show an improvement as compared with the year 1909.

KAISER WILHELM CANAL.—The traffic of vessels through the Kaiser Wilhelm Canal is increasing from year to year; 35,236 vessels used the Canal in 1909, while in 1910 the number was 43,328. The new locks will be 330 metres long, larger than those of the Panama Canal.

TUGBOATS.—The activity of Hamburg engineers has secured for them an order for two tugboats for South America; the one is to have an engine of 150 and the other of 100 H.P. A third order is for Africa with an engine of 120 H.P.

FRANCE.—PASSENGER STEAMERS FOR TURKEY.—Three passenger steamers for Turkey have been ordered in France. They are under construction by the Shipbuilding Yard de Provence, and their dimensions are as follows:—Length over all, 61·26 metres; breadth, 9·15 metres; draught, 1·88 and 2·38 metres. Accommodation will be provided for 700 passengers first-class, and 542 passengers second-class, in the five saloons, one of which is to be reserved for the ladies of the harem. They will be heated by steam and lighted by electricity. The two screws will be protected by a special construction of the hull, and the engines are of the triple-expansion type, developing 600 H.P. and giving a speed of 14 knots. The vessels are to be delivered in September.

NEW STEAM PACKET OF THE WESTERN RAILWAY OF FRANCE.—The new steam packet of the Western Railway of France has already taken up her duties of conveying passengers and traffic between Newhaven and Dieppe. She has been built by the Chantiers de la Mediterranée at Havre, and has turned out quite a success. She is equipped with eight Belleville boilers at a working pressure of 17 kilos per sq. cm., and has also economizers installed. The construction of the grates is of the Belleville type with closed ashpits, and the forced draught is created by two Belleville compressors. The driving power consists of three Parson's turbines, of which one works on high and two on low pressure. There are two condensers, each with 392 sq. m. and a circulating pump able to deliver 1,750 cub. metres an hour, and fitted up to pump from the hold if required. Two air pumps of 400 cubic m. can serve both condensers at will. The vessel is generally of very attractive appearance. The *Newhaven* has a length overall of 92 metres; between perpendiculars, 89 metres; breadth overall, 10·55 metres; moulded depth, 4·45 metres; draught, 2·92 metres. On the trial trip she crossed in 2 hours 43½ minutes (the contract limit was 3 hours), giving her a speed at 24 knots per hour. Her turbines developed 10,000 H.P., as against the contract power of 7,500 H.P. The conditions of stopping the ship were very severe. When going at a speed of 12 knots she was to be brought to a stop in less than 120 metres; at the trial this was accomplished in 90 metres. The draught contracted for was 2·95 metres with the vessel in full working trim; at the trial it did not exceed 2·92 m. The decks are of wood, being more comfortable for the passengers. The passenger accommodation is beautifully decorated with various stained woods and velvet in elegant patterns. She is to accommodate 1,000 passengers in first and second-class. It may be mentioned, as a new feature, that the vessel has special accommodation for four motor-cars of the largest size of about 2,500 kilos each. We note with pleasure that English work has played an important part in making the *Newhaven* one of the best boats that ever crossed the Channel.

ITALY.—Diesel motors are being now utilized for several steamers. Among these is the steamer *Romagna*, which has just been launched at the Cantieri Riuniti at Ancona. The machine plant is to consist of two reversible Diesel motors of 1,800 H.P. which are being supplied by Messrs. Sulzer & Co.

UNITED STATES OF AMERICA.—The Great Lakes Engineering Works in Detroit have received an order from the Shenango Steamship Company for two cargo steamers of 15,000 tons each. The length is 188 and the breadth 19·51 metres. Three boilers will supply the steam for the quadruple-expansion engines.

HOLLAND.—The Dutch Factory van Werktingen at Amsterdam has received orders for three Diesel motors, one being 1,100 H.P. for a tank vessel of 4,250 tons displacement, and the two others of 2,200 I.H.P. are to be put into a tank vessel of 9,300 tons displacement, driving two screws. These orders should have been secured by English firms.

AUSTRIA.—A steamer is being built which will be the largest and quickest ocean liner of the Austrian merchant service. It is being built in the Yard Cantreri Triestino at Monfalcone for the Austro-American Line. Its dimensions are 152 metres in length, 19·9 in breadth, with a draught of 7·9 metres and having a displacement of 18,000 tons. The speed is to be 18 knots per hour, which will be obtained by 12,800 H.P., developed by two quadruple-expansion engines. There will be accommodation for 150 passengers of first, 450 of second, and 1,800 of third-class, for a crew of 300 men and also for a cargo of 7,000 tons. Her name will be *Kaiser Franz Joseph I.*, after the Emperor. The launch is to take place in July of this year, so that she is expected to make her first voyage before the end of the year.

NORWAY.—The Norwegian Government has decided to grant a subsidy of 500,000 kroner to assist a new American Steamship Line for three years, and steamers for the same will shortly be required, for which no doubt tenders will be invited from this country.

JAPAN.—The competition in the shipbuilding industry is now being increased by Japan. This enterprising country has no less than 239 shipbuilding yards, and they turned out 58 steamers in the past year against 35 in 1909. This great increase in one year is a proof that the Japanese are hard at work, and in due course orders from that quarter will decrease.

CHINA.—The Shipbuilding Yard at Tsingtau, originally intended only for repairs, has now for the first time built a steamer after its own designs for the Chinese Admiralty. The vessel is 38·5 metres long, 5·8 metres broad, and has a draught of 1·8 metres. The speed trials have shown that this first attempt has been quite successful. This yard works under very favourable circumstances and gives a large surplus.

CORONATION EXHIBITION, SHEPHERD'S BUSH, LONDON, W.—This Exhibition does not contain many exhibits of a technical character to interest marine engineers; there are fewer of such indeed this season than in former exhibitions held in the same place. Still it is well to pay visits to such places, even though the eye is not called upon to absorb our every-day technicalities; in some respects indeed it is an educational advantage to enjoy a respite from the hobby of work and allow the mind to dwell on the passing show spread out within the grounds. The Indian section is interesting to those who have been in the East; many of the reproductions are good and the work being done is as in the bazaars; the illustrations, however, hardly coincide with memories of the actual scenes, yet to those who have not been favoured with views of the realities, the representations convey a good idea of what exists. There are several good models of steamships in part of what was formerly the Machinery Hall; these serve to illustrate various types of vessels; among these the *Slavonia* (Cunard Co.) was seen to advantage under the name of the builders (Sir Jas. Laing & Co.) The models of the most modern passenger, coastal and cross channel service steamers on view show the great advances made during the last twenty years by the Railway Companies in catering for the ever-increasing number of sea-going travellers, thus emulating the example of the large Steamship Companies who are vieing with one another in adding luxury upon luxury to the comforts previously provided on their vessels. Models of dredgers are always interesting and those on view show the principle of action, arrangement of buckets and other details in the equipment of the modern dredger. One of the wings of the Hall is devoted to the press, and illustrates historically the progress which has been made by the various journals and papers of the day from the date of their foundation.

INSTITUTE OF MARINE ENGINEERS.

Visit to Beckton Gas Works.

ON Saturday, May 27th, the Institute of Marine Engineers paid a visit to the works of the Gas, Light and Coke Company at Beckton. The first gas company ever established, it appropriately claims precedence, also in owning the largest gasworks in the world. An impression of their extent may be obtained when it is stated that they cover 270 acres of ground, and communication is established between the different parts of the works by means of a network of railways with a total length of 40 miles, with twelve signal boxes and thirty-two locomotives. There are fourteen retort houses, each with its own complete set of purifying apparatus, and each forming in itself a gas works of no mean size. There are nine gas-holders in all—one of them having a capacity of nine million cubic feet—but comparatively little of the gas is stored, about 50,000,000 ft. being pumped to London during the twenty-four hours. The total capacity is 75,000,000 ft., including 13,000,000 ft. of carburetted water gas.

Before proceeding to the gas-making plant the visitors were shown round the constructional, repairing and tool-making shops. There are seventy-two Lancashire and Babcock boilers used, the furnaces including the "Beckton," a special type constructed on the works for burning coke "breeze" under pressure. The forge, which is a building of fairly large size, contains thirty fires and three steam hammers.

The largest retort house at present in use is 510 ft. long and 100 ft. wide. It contains 405 retorts and can produce 5½ millions cubic ft. per day. The retorts, consisting of fireclay tubes 20 ft. in length, are arranged in beds of nine, surrounding a central combustion chamber, the hot gases from the furnaces beneath being conveyed round the retorts and returned to the bottom tunnel, through which they are conveyed to the central smokestack. Vertical iron pipes at the mouths of the retorts carry the crude gas distilled from the coal to the top of the retort beds and into a rectangular hydraulic main running along the length of the beds. The water in this pipe acts as a valve, preventing the gas returning through the vertical pipe when the retorts are opened for discharging and filling, and also acts as a purifier, a large proportion of the tar and ammonia contained in the gas being deposited. From the hydraulic main, the gas is withdrawn by exhausters, the coal being thus distilled in a partial vacuum, the gas is more readily given off by it. The gas is then conveyed through condensers, of which there are two types used, the vertical and horizontal, the purpose of the apparatus being to condense, by the free circulation of air around the pipes, the tar and ammonia left in the gas. These products are then run off into the storage tanks and the cooled gas, which still contains a considerable amount of ammonia, carbonic acid and sulphuretted hydrogen, is passed through the washers, or scrubbers. These are circular cast-iron towers, about 60 ft. in height, filled with coke. Weak ammoniacal liquor or clean water percolates through the coke, meeting the ascending gas and removing therefrom the whole of the remaining ammonia, carbonic acid and sulphuretted hydrogen being also absorbed to some extent.

The gas next passes through eight sets of purifiers, two containing carbonate of lime to remove the carbonic acid; two containing oxide of iron to remove the sulphuretted hydrogen; two containing sulphuretted lime to remove the bi-sulphide of carbon, and lastly, through two vessels containing clean lime to remove the last traces of sulphuretted hydrogen.

In addition to purifying the gas, the value of the residual products from these purifying processes reduces the expenses of manufacture by about 40 per cent.

After leaving the purifiers the gas is passed through the large station gas-meters before being conveyed to the gas-holders, where it is stored for use as required. It is pumped through to Westminster along cast-iron mains of 4 ft. diameter at a pressure of 48 lbs., by means of eight large gas-exhausters, on Beale's rotary plan, each capable of pumping 250,000 cubic ft. per hour.

Considerable interest was shown in the apparatus for filling and emptying the retorts. Three types are used at Beckton: the West, driven by compressed air; the Arrol-Foulis, by hydraulic power, and the electrically-driven Fiddes-Aldridge. The last-named apparatus fills and discharges at one operation. It consists of a series of iron boxes fixed on a revolving wheel. By means of a shoot fed by overhead hoppers, coal is shot into the line of boxes as they enter the retort. The front end of the first box is fitted with an arrangement which pushes the hot coke out at the other end of the retort, and when the boxes have traversed the length of the retort, a feathering plate at the bottom enables the boxes to be withdrawn, leaving the coal deposited in the retort. The hot coke is caught on a conveyor containing water, part of it to be used to heat the furnaces and the remainder to be taken away for commercial use.

The coal is allowed to remain in the retort for eight hours at a uniform heat of about 2,000 deg. F. The wear and tear upon the retorts is naturally very heavy, and they are renewed about every four years.

After looking over the works the party was taken by rail to the pier, a structure built on cast-iron cylinders and projecting about 150 yards from the shore, and with a river frontage of 800 ft. There are five berths, each giving accommodation to the largest size of steam collier, and, by means of twelve large hydraulic cranes, the unloading power is equal to 12,000 tons per day. The average consumption of coal at the works is about 40,000 tons per week, each ton of coal giving from 11,000 to 12,000 cubic ft. of gas.

A large quantity of oil is used for the purpose of enriching the gas, making carburetted water gas, in the manufacture of which the Beckton works was the pioneer. By means of this plant, gas can be so obtained of any illuminating power up to 30 c.p.

The coal testing plant, which is really a miniature gas works, proved of great interest. Samples of 50 tons are tested at a time, the final result being shown by means of the photometer, an instrument by which the jet of flame is measured relatively to the pressure.

After partaking of refreshments kindly provided by the Company, a vote of thanks was accorded, on the proposal of Mr. W. McLaren, seconded by Mr. F. M. Timpson, to the Company and to Messrs. Solomon, Rainey, Hunter and Wheeler, under whose guidance the inspection was made.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES - English.

Orcades and Lacerta.—On May 1st, there was launched from the shipyard of Messrs. Cochrane & Sons, shipbuilders, Selby, two steel screw trawlers, the principal dimensions being, 128 ft. by 22 ft. by 13 ft. 4 in. moulded. The vessels have been built to the order of Messrs. The Dolphin and Lindsay Steam Fishing Co.'s, Ltd., of Grimsby, and will be fitted with powerful triple expansion engines by Messrs. Amos & Smith, Ltd., of Hull, and is replete with all the latest improvements for fishing purposes.

Harpalyce.—On May 1st, Messrs. William Gray & Co., Ltd., launched the handsome steel screw steamer *Harpalyce*, which they have built to the order of Messrs. J. & C. Harrison, Ltd., London. She will take the highest class in Lloyd's Register, and is of the following dimensions, *viz.*: Length overall, 441 ft.; breadth, 53 ft. 6in.; and depth 31 ft. 8in., with two decks laid, long bridge, poop and topgallant forecastle. The hull is built with deep frames and holds quite clear of all obstructions, cellular double bottom and large aft and fore peak ballast tanks, fourteen steam winches, return exhaust pipes and winch condenser, steam steering gear amidships, hand screw gear aft, four masts with telescopic topmasts, derrick tables, outriggers and twenty-two derricks, also Porter's patent derrick sockets for dealing with heavy lifts, patent direct steam windlass, fresh water distiller, shifting boards, trunks and feeders for bulk grain cargoes, stockless anchors, steel lifeboats, icehouse, ventilation for the Eastern trade, electric lighting and all requirements for a first-class cargo steamer. The engine and boiler-room, tank tops, bunkers and tops of casing, etc., are coated with Bitumastic Enamel. The machinery will be supplied by the Central Marine Engine Works of the builders, the engines, triple expansion, having cylinders 28 in., 45 in., and 75 in. diameter, by 51 in. stroke, the

main condenser is designed to maintain a high vacuum, whilst attention has been given to ensure a high temperature in the boiler feed water. Steam is generated in four large boilers of the builders' "flanged shell" type at a pressure of 180 lbs. per square inch, the heating surface being over 8,900 square feet, and is worked under Howden's system of forced draught, with the bronze propeller fitted the speed of the vessel will be about 11 knots.

Corte.—On May 1st, there was launched on the Tyne, by Messrs. Swan, Hunter & Wigham Richardson, Ltd., a fast passenger steamer which is being built to the order of Messrs. Fraissinet & Co., of Marseilles, for their Corsican mail and passenger service. The vessel, which is built of steel, is 280 ft. in length by 37 ft. beam, and is being constructed under the special survey of the Bureau Veritas. She will be propelled by four-crank, triple-expansion engines, balanced on the Yarrow, Schlick and Tweedy system, and designed to drive the vessel at a speed of 17½ knots. The engines, together with the boilers, are also being built by Messrs. Swan, Hunter & Wigham Richardson, Ltd. The accommodation, which is for 50 first-class passengers, includes dining saloon, staterooms and smoke-rooms, all of which are handsomely furnished and fitted up in luxurious style. There is also accommodation for 60 second-class passengers, berths for 24 third-class passengers, and shelter for deck passengers. A Cochran (Annan) donkey boiler with patent seamless furnace has been supplied and fitted.

Craigston.—On May 2nd, Messrs. William Gray and Co., Ltd., launched the steel screw steamer *Craigston*, which they have built for Messrs. John Cory & Sons, Ltd., Cardiff. She will take the highest class in Lloyd's Register, and is of the following dimensions, *viz.*: Length overall, 311 ft.; breadth, 46 ft.; and depth 21 ft. 7½ in. She is a handsomely modelled vessel of the one-deck type with poop, bridge and topgallant forecastle. Tasteful cabin accommodation will be fitted up in the poop for captain and officers, the engineers being berthed in houses on the bridge and the crew in the forecastle. The hull is built with deep bulb-angle frames, clear holds, cellular double bottom and large after peak ballast tanks. There are four powerful steam winches placed on raised platforms with double derricks to each for rapidly discharging coal and powerful warping winch on poop, horizontal multitubular donkey boiler, steam steering gear is fitted amidships and hand screw gear aft, patent direct steam windlass, stockless anchors, telescopic masts with fore and aft rig, and a first-class outfit for the vessel's special trade. The machinery is made by the Central Marine Engine Works of the builders, being of the triple expansion type with cylinders 22 in., 36 in., and 60 in. diameter, with a piston stroke of 39 in., and is fitted with two large steel multitubular boilers to work at a pressure of 180 lbs. per square inch.

Braunton.—On May 11th, Messrs. Richardson, Duck and Co. launched from their yard a steel screw steamer of the following dimensions, *viz.*: Length overall, 393 ft. 6 in.; breadth extreme, 50 ft.; depth moulded, 29 ft. 2in., with a deadweight carrying capacity of 7,500 tons. This vessel, which has been built to the order of the Tatem Steam Navigation Co., Ltd., of Cardiff, will take highest class in British Corporation Registry, and has been built under special survey. She is a single deck steamer, with wide spaced channel frames. Steel centre division is fitted in holds, in which there are no beams nor quarter pillars. Vessel has cargo poop, bridge amidships, and topgallant forecastle, with very large hatches to expedite the loading and discharging. Special accommodation for captain, officers, and engineers is provided in steel deckhouses on bridge deck, petty officers and apprentices being berthed under bridge at after end, and crew in topgallant forecastle. A cellular double bottom for water ballast is fitted throughout except under boilers. Vessel has also peak tanks, and equipment includes seven steam winches, exhausting into Contraflo winch condenser, large horizontal multitubular donkey boiler, 14 derricks, steam windlass with quick warping ends, steam steering gear, etc. The engines, by Messrs. Blair & Co., Ltd., have cylinders 25 in., 42 in., 68 in., by 45 in. stroke, steam being supplied by two extra large single-ended boilers having a working pressure of 180 lbs. fitted with Howden's forced draught.

Seaford.—Messrs. William Dobson & Co. have recently launched from their shipbuilding yard at Walker the steel screw steamer *Seaford*, which they have built to the order of Messrs. Stephenson, Clarke & Co., of London, for their coal coasting trade. The vessel is 164 ft. long, 30 ft. beam, and 14 ft. deep, and is built to the highest class at Lloyd's, with all the latest arrangements of a modern collier. The machinery is placed in the after end of the steamer, and has been constructed by the North-Eastern Marine Engineering Co., Ltd., of Wallsend. The engines are of the usual triple expansion type, having cylinders 15½, 25, 41 by 30 in. stroke, with one boiler 180 lbs. pressure.

Two Steel Tugs.—The Goole Shipbuilding and Repairing Co., Ltd., have recently launched from their Victoria Shipyard, Goole, two handsomely modelled steel screw tugs of the following dimensions: Length overall, 85 ft. 6 in. by 23 ft. by 12 ft. 3 in. The vessels have been built considerably above Lloyd's highest class, and under special survey, and are fitted with steam windlass, steam steering gear, and nice cabin accommodation. A steam fire pump is to be fitted in each vessel. Triple expansion engines will be fitted by Messrs. Earle's Shipbuilding and Engineering Co., Ltd., of Hull. The vessels have been built to the order of Messrs. The Argentine Navigation Co. (Nicolas Mihanovich), Ltd. These are the first two tugs of four that the firm are building for the same owners.

Chinese Prince.—On May 12th, the s.s. *Chinese Prince* was successfully launched from the shipyard of Messrs. Short Brothers, Ltd., Pallion, Sunderland. She has been built to the order of Jas. Knott, Esq., for the Prince Line, Ltd., of Newcastle, and her leading dimensions are: Length, 410 ft.; beam, 54 ft. 4 in.; and depth moulded, 28 ft. 1 in. Taking Lloyd's highest class, the vessel has complete shelter deck with upper and main decks and is divided by six watertight bulkheads. Water ballast is provided throughout the double bottom in fore and after peaks, and in a large chamber tank to height of main deck fitted just aft of engine-room. The decks are supported by strong girders below beams with wide spaced tube pillars at corners of hatches. The loading and discharging arrangements have received special attention, sixteen derricks being fitted on strong tables at masts with crosstrees above and four derricks on posts working from six large hatches. Twelve steam winches, steam windlass, ash hoist with shoot overboard, steam steering gear fitted in engine-room, controlled from wheelhouse on upper flying bridge and connected by rods and chains to double armed quadrant on rudder head, are supplied, driven from a large multitubular donkey boiler fitted on upper deck. Hand steering gear is fitted in house aft. Accommodation for twelve passengers, with saloon artistically panelled in polished oak, bathrooms, pantry, etc., is fitted in large house on shelter deck. Captain's room, chartroom, and office are arranged in house above saloon house with a wheelhouse above. The officers and engineers are berthed in houses alongside engine casing on shelter deck, and the crew and petty officers in the after end of shelter deck. Steam heating and complete sanitary service are provided in accommodation. An installation of electric light is installed throughout the vessel. The propelling machinery will be fitted by Messrs. The North-Eastern Marine Engineering Co., Ltd., of Sunderland, and consists of triple expansion engines with cylinders 27, 45, and 74 inches diameter, and a stroke of 51 inches, taking steam from three large multitubular boilers of 180 lbs. pressure and fitted with Howden's system of forced draught. Messrs. Walker, Lyon & Co.'s "Bituminite" Enamel was applied to the 'tween deck bunkers and pocket bunkers, etc.

Mary Baird.—On May 15th, Messrs. Craig, Taylor & Co., Ltd., launched from their Thornaby Shipbuilding Yard, Thornaby-on-Tees, a handsomely modelled single deck screw steamer of the following dimensions, *viz.*: 306 ft. by 45 ft. by 22 ft. 6 in. moulded. She is built of steel to the highest class in Lloyd's Registry, under special survey, and has poop, bridge and topgallant forecastle; water ballast in double bottom fore and aft and in peaks. She is equipped with patent steam windlass with quick warping ends, steam steering gear, five steam winches, and "Riley" patent donkey boiler; telescopic masts, and all the latest improvements for rapid loading and discharg-

ing. The accommodation for captain and officers is neatly fitted up in deckhouses amidships, the engineers being in deckhouse alongside engine casing, and the crew in the forecastle. Her engines have been constructed by Messrs. MacColl & Pollock, Ltd., Sunderland, the cylinders being 22½ in., 36½ in., 60 in. by 39 in., with two large steel boilers working at 180 lbs. pressure. In addition to general trades, the vessel is also specially adapted for timber carrying. The vessel has been built to the order of Messrs. J. W. Baird & Co., of West Hartlepool, for the Baird Shipping Co., Ltd., under the superintendence of Mr. Wm. Graham, M.I.M.E., Consulting Engineer and Marine Superintendent, of West Hartlepool.

Two Steel Screw Trawlers.—On May 13th, there were launched from the yard of Messrs. Cochrane & Sons, Selby, two steel screw trawlers, built to the order of Milford and Grimsby owners. The vessels will be replete with all the latest improvements for the trawling trade, and will be fitted with powerful triple expansion engines by Messrs. C. D. Holmes & Co., Hull, and the Great Central Co-operative Engineering and Ship Repairing Co., Ltd., Grimsby, respectively. As the first vessel left the ways she was gracefully christened *Weigelia* by Mrs. Mark Scott, and the other vessel was christened by Mrs. Cochrane, after which the company adjourned to the builders' offices, where the customary toasts were given and responded to.

Bansara.—On May 13th, the launch took place at the yard of Hepple & Co., Ltd., of South Shields, of this vessel, which has been built for Elder, Dempster & Co., Ltd., for African service. The dimensions of this craft are: Length, 105 ft. by 21 ft. by 7 ft., and she is fitted with two sets of triple expansion engines, capable of developing sufficient power to obtain a speed of eleven miles per hour with a large cargo on a very light draft. A spacious bridge will be arranged for, on which passenger accommodation will be located. The officers are berthed aft, the crew in the forecastle. Two steam winches and four hatches are provided.

Mile-End.—On May, 25th, Messrs. William Dobson and Co. launched from their shipbuilding yard at Walker a steel screw steamer which they have built to the order of the Commercial Gas Co., of Stepney, London. The vessel has been built to the highest class at Lloyd's, and is of the following dimensions: Length between perpendiculars, 165 ft.; breadth, 38 ft.; depth moulded, 15 ft. 4 in. The steamer has been specially constructed for the Commercial Gas Co.'s coal trade between the Tyne and their works on the Thames. The machinery is being built by Messrs. MacColl & Pollock, Ltd., of Sunderland, and is of the usual triple expansion type, having cylinders 17½, 29, 48 by 33 stroke with one large boiler.

Dalebank.—On May 24th, a large assembly gathered at the yard of the Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne, to witness the launching of a finely moulded steamer for the firm of Taylor & Worthington, of Liverpool. The vessel, which is a duplicate of the s.s. *Dalecrest,* recently built by the Northumberland Shipbuilding Co., Ltd., for the same firm, is 390 ft. long by 49 ft. beam, by 29 ft. deep, and has been built under special survey to the highest class at Lloyd's. She is fitted with long bridge, long poop, topgallant forecastle, the accommodation, which is ample, being placed in steel houses on bridge deck. Careful attention has been devoted to the loading and discharging gear, and a complete outfit for the rapid handling of cargoes arranged for, consisting of eight steam winches, by Messrs. Clarke, Chapman & Co., Ltd., Gateshead-on-Tyne, a large number of cargo derricks, and steam windlass by Clarke, Chapman and Co., Ltd. She is fitted with the usual water ballast arrangements for light passages. The machinery is to be supplied by Messrs. Richardsons, Westgarth & Co., Ltd., Sunderland, consisting of engines with cylinders 25, 41, 69 by 48 in. stroke, three large steel boilers with 180 lbs. pressure. The vessel will carry about 7,500 tons on a light draft, and steam about 10 knots loaded at sea.

Izgled.—On May 26th, Messrs. Wm. Doxford & Sons, Ltd., launched from their yard at Pallion, Sunderland, a single deck vessel built to the order of Messrs. Racich, Lucovich, Banaz & Harris, Ltd. The dimensions are: Length, 385½ ft.; breadth, 50 ft.; moulded, 28¾ ft. Deadweight capacity 7,500 tons on a moderate draft. The engines and boilers are being constructed by Messrs. Doxford. The *Izgled* has been built to Lloyd's and Austrian Veritas classifications, and under the inspection of Mr. Baxter, of Newcastle, on behalf of the owners.

Torilla.—On May 27th, there was launched from the Jarrow Yard of Palmers' Shipbuilding and Iron Company, Ltd., the handsomely modelled steel screw passenger and cargo steamer *Torilla,* built to the order of the British India Steam Navigation Company, Ltd. The vessel, which is over 400 feet long, has been built to Lloyd's highest class under special survey, and has Board of Trade passenger and emigrant certificates. There are three complete steel decks, with poop, bridge, and boat decks. The first-class passenger accommodation is fitted in single and two-berth cabins in a large deck house on the bridge and on the shelter deck inside the bridge. Accommodation for the second-class passengers is arranged in two and three-berth cabins in the poop. The upper and main decks are reserved for the emigrants' sleeping quarters and dining spaces. A large dining saloon for the first-class passengers is situated at the fore end of the bridge. The second-class dining saloon is at the fore end of the bridge deck, while at the aft end of the same deck is the smoke room. The vessel is lighted throughout by electricity. Derrick posts and winches are fitted at all cargo hatches to enable her to handle cargo rapidly. The steamer is fitted with triple expansion engines, taking steam from four large boilers, working under forced draught. These also are being constructed by the builders, and will be capable of driving the vessel at a speed of between 12 and 13 knots.

Lord Haldane & Lord Wenlock.—On May 29th, there were launched from the shipyard of Messrs. Cochrane and Sons, shipbuilders, Selby, two steam drifters, the principal dimensions of which are as follows: Length, 84 ft.; breadth, 18 ft.; depth moulded, 9 ft. 6 in. The vessels have been built to the order of Lowestoft owners, and will be fitted with compound surface condensing engines by Messrs. C. D. Holmes & Co., Ltd., of Hull, and will be replete with all the latest improvements in this class of vessel.

Corjistan.—On May 29th, Messrs. William Gray & Co., Ltd., launched the large steel screw steamer *Gorjistan,* which they have built for Messrs. Frank C. Strick & Co., Ltd., Swansea and London. The vessel will take the highest class in Lloyd's Register, and is of the following dimensions, viz.: Length overall, 384 ft. 6 in.; breadth, 50 ft.; and depth, 30 ft. She is a handsomely modelled vessel of the double deck type, with poop, long bridge, and topgallant forecastle, having very tasteful cabin accommodation in houses on the bridge deck for passengers, captain and officers, and is fitted throughout with electric lighting. The vessel has a cellular double bottom and after peak tank for water ballast, and in addition there is a deep tank or hold compartment fitted for water ballast abaft the engine room, giving a total capacity for water ballast of about 2,000 tons. The whole of the outfit, including steam windlass, steam steering gear, ten steam winches, with return exhaust to winch condenser of the Contraflo type, are of the most approved description. The machinery is made by the Central Marine Engine Works of the builders, being of the triple expansion type, with cylinders 28 in., 46 in., and 77 in., with a piston stroke of 48 in. She is fitted with a Contraflo main condenser, Weir's feed pumps and heater and large steel multitubular boilers working by Howden's forced draught at a pressure of 180 lbs. per square inch.

Princess Alice.—On May 29th, in brilliant weather, Messrs. Swan, Hunter & Wigham Richardson, Ltd., launched from their Wallsend Shipyard the finely modelled passenger steamship *Princess Alice,* which is being built for the Canadian Pacific Railway Co., for their steamship service between Vancouver, Victoria and Seattle on the Pacific Coast. The design and construction of this handsome vessel has been supervised by the Company's steamship representatives in England. The *Princess Alice* is about 300 ft. long with a breadth of 46 feet. She is built to the highest class of Lloyd's, and in accordance with the requirements of the Canadian Government for passengers in channel or Pacific Coast service. The main engines, constructed by the Wallsend Slipway and Engineering Co., are triple expansion, with

four cranks balanced on the famous Yarrow, Schlick and Tweedy system to eliminate vibration. The vessel is designed for a speed of close on 18 knots per hour. In addition to the ordinary coal bunkers, the ship will carry fuel oil and the boilers will be fitted with a complete installation of oil-burning apparatus. The arrangements for the accommodation and comfort of the passengers have been planned so as to be second to none in a vessel of this class. In addition to the commodious cabins extending the whole length of both the upper and promenade decks, there will be several suites of bridal chambers. On the main deck aft is the dining room. Below the dining room is a restaurant with seating accommodation for about a hundred persons at small tables. On the promenade deck forward is the observation room with large plate glass windows on three sides, which is a particularly comfortable apartment. At the after end of the same deck is the first-class smokeroom, furnished in fumed oak. This is another handsome and comfortable room with wide and lofty windows and surmounted by a stained glass dome. On the upper deck both forward and aft of the engine and funnel casing there are large social halls or music-rooms. The corridors of the promenade deck will be specially lofty and well lighted by having a coach roof extending over their full length.

Nigaristan.—On May 29th, Messrs. Irvine's Shipbuilding & Dry Docks Co., Ltd., launched from their Harbour Dockyard, West Hartlepool, the handsome steel screw steamer *Nigaristan,* built to the order of Messrs. F. C. Strick & Co., Ltd., of Swansea and London. The dimensions are 385 ft. long by 50 ft. beam extreme by 30 ft. depth moulded, and the vessel has two complete decks, with poop, bridge and forecastle, and is built to Lloyd's highest classification. A double bottom is fitted throughout for water ballast, and a large deep tank is fitted abaft the engine room bulkhead. She is constructed with bulb angle frames and longitudinal stringers, and is fitted with seven watertight bulkheads, five large hatches are provided, and all the latest facilities for the rapid loading and discharging of cargo, ten steam winches, fourteen derricks (including two to lift 30 tons each). A powerful quick warping steam windlass is fitted forward, steam steering gear amidships and hand gear aft. Electric light is fitted throughout the vessel, including arc lamps at the large hatches and a searchlight on the forecastle head. The captain, officers and engineers are berthed in large houses amidships, together with accommodation for about twelve first-class passengers, the sailors and firemen being berthed in the forecastle. The lighting, heating and sanitary arrangements have received special attention, the most improved methods having been adopted throughout. The propelling machinery, which will be fitted by Messrs. Richardsons, Westgarth & Co., Hartlepool, has been built to a very complete specification, and embodies the latest practice in marine engineering. The engines are of the triple expansion type, having cylinders 28 in., 46 in., and 77 in. by 48 in. stroke, with large forced draught boilers working at a pressure of 180 lbs. A feature in the design of the machinery is the adoption of the complete "Contraflo" system of condensing and feed heating. This consists of both main and auxiliary condenser of the Contraflo type, independent feed pumps, cascade filter, and a special design of feed heating arrangement whereby the whole of the auxiliary exhaust steam is utilised. In addition to the usual general purpose and feed donkey a separate float controlled feed pump will be fitted for use in port, and also a separate circulating pump for the auxiliary condenser. The evaporator will be of the Morison vertical radial type, and other accessories include steam ash hoist, etc. The propeller is arranged with loose bronze blades, and has been designed to suit the special conditions under which the engines will be run.

Henrik.—On May 29th, Sir Raylton Dixon & Co., Ltd., launched from their Cleveland Dockyard, Middlesbrough, a fine steel screw steamer which they are building to the order of Messrs. Bruusgaard, Kiösterud & Co., of Drammen, Norway. The vessel is being constructed under special survey to class 100 A1 at Lloyd's, and to pass Norwegian Veritas, and is of the single deck type with poop, long bridge and forecastle. Her principal dimensions are 372 ft. by 26 ft. 5 in. moulded, and she will have a deadweight carrying capacity of about 7,400 tons on a light draft of water. Saloon and captain's room will be fitted up in large steel house amidships, with chart room and office on top, and flying bridge above this. The officers' and engineers' accommodation will be provided in side houses abreast engine casing, while the firemen and crew will be located aft in poop. The vessel has four holds, five hatches, two masts, and she will be equipped with ten derricks, ten steam winches, steam windlass, two large donkey boilers, hand and steam steering gear, and all the latest and most modern appliances for the rapid handling of cargo. Triple expansion engines having cylinders 25, 41 and 68 by 48 in. stroke, supplied with steam by two very large single-ended boilers working at 180 lbs. pressure, will be fitted by the North-Eastern Marine Engineering Co., Ltd., Wallsend-on-Tyne.

Darnholme.—On May 29th, Messrs. Robert Thompson and Sons, Ltd., launched from their Southwick Yard a first-class finely modelled cargo steamer, built to the order of Messrs. Thos. Smailes & Son's Steamship Co., Ltd., of Whitby, being the fourth vessel they have built for the same owners. Her principal dimensions are: Length overall, 361 ft. 4 in.; breadth, 50 ft.; and depth moulded 25 ft. 10 in. She will take the highest class at Lloyd's, and is constructed with single deck and designed to carry a large deadweight cargo on a light draught. Ample water ballast is provided in the cellular bottom and the after peak. Full cargo poop and bridge are fitted, and topgallant forecastle for the crew. Accommodation is provided for the chief officer, second officer, steward, spare room, and dining saloon, etc., tastefully fitted up in oak in a large steel house at the fore end of the bridge. The captain's sitting and sleeping rooms, also chart room, are fitted above this house, under the upper flying bridge. The engineers', petty officers' and apprentices' berths, with messroom, bathroom, etc., are situate in steel houses abreast the engine casing. There are five cargo hatchways, with double derricks fitted on tables, and cross trees at masthead, also derrick posts to bridge hatches, worked by six powerful steam winches, and a large multitubular donkey boiler of ample capacity for the supply of steam to the deck machinery. The engines by Messrs. The North Eastern Marine Engineering Co., Ltd., Sunderland, having cylinders 25 in., 42 in., and 68 in., with a stroke of 45 in., steam being supplied by large boilers working at a pressure of 180 lbs. per square inch.

Bayardo.—On May 29th, the handsomely modelled new royal mail steamship, *Bayardo,* built to the order of Messrs. Thos. Wilson, Sons & Co., Ltd., Hull, for their Gothenburg service, was launched from the yard of Earle's Shipbuilding and Engineering Co., Ltd., Hull. Her dimensions, etc., are as follows: Length B.P., 330 ft.; breadth, 47 ft.; depth moulded, 35 ft.; gross tonnage, 3,570 tons; displacement, 5,250 tons; horse power, 3,600. The *Bayardo* is being built under special survey, to Lloyd's 100 A1 highest class, and with a full Board of Trade passenger certificate. She will carry over 100 saloon passengers, and sumptuous accommodation is provided for them, she will doubtless prove herself the queen of the fleet. The smoking room at the fore end of the promenade deck, is panelled in walnut and paved with rubber tiles, and the dining saloon on the upper deck is a magnificent room panelled in fumed oak. The second-class accommodation differs from the first-class only in being rather less ornate, and here the passengers will find a large dining saloon, a well equipped smoking lounge, and a breezy promenade. Special care has been taken in the construction of the pantries, kitchens, cold storage and refrigerated chambers, all of which are arranged in accordance with modern scientific principles. All the lavatories, bathrooms, and other conveniences are of the latest type, well lighted and ventilated, and perfectly sanitary. The steamer is fitted with wireless telegraphy and submarine signalling installation, and will be constantly in touch with either England or the Continental wireless stations. The *Bayardo* is intended to take up her staion on the Gothenburg service leaving Hull on Thursday, July 20th, and she will run alternate weeks with the *Calypso,* leaving Hull on Thursdays at 6.30 p.m. from the Riverside Quay, arriving in Gothenburg early Saturday morning, giving a quick despatch for passengers travelling through Sweden to Stockholm, Finland and St.

Petersburg. The machinery will consist of a set of fast running triple expansion engines, balanced to reduce vibration to a minimum, and three large boilers working at 180 lbs. pressure and fitted with forced draught. Messrs. Wailes, Dove & Co.'s Bitumastic Enamel was applied to the cellular double bottom, bunkers, etc.

Xylopia and Princeps.—On May 30th, there were launched from the yard of Messrs. Cochrane & Sons, Selby, two steel screw trawlers built to the order of Milford and Grimsby owners. The vessels will be replete with all the latest improvements for the trawling trade, and will be fitted with powerful triple expansion engines by Messrs. C. D. Holmes & Co., Ltd., Hull.

Brierton.—On May 30th, Messrs. Irvine's Shipbuilding and Dry Docks Co., Ltd., launched from their Middleton Shipyard, the steel screw steamer *Brierton,* built to the order of the Brierton Shipping Co., Ltd. (Messrs. Sydney Hogg & Co., managers), West Hartlepool. The dimensions are: 352 ft. long by 47 ft. 9 in. beam extreme by 25 ft. 6 in. depth moulded, and the vessel is built to Lloyd's highest classification, having a single deck, with poop, bridge and forecastle. Cellular double bottom is fitted throughout for water ballast, and the fore and after peaks are available as trimming tanks. The steamer is constructed with deep frames and longitudinal stringers, giving clear holds for the stowage of bulky cargo, and is divided into six watertight compartments by means of five watertight bulkheads, whilst wood grain divisions are fitted in the holds. There are extra large cargo hatches, seven steam winches worked from multitubular donkey boiler, and all the latest improvements are included in the outfit of the vessel. A powerful quick-warping steam windlass is fitted forward, and steam steering gear amidships, with hand screw gear aft. The captain, officers and engineers are berthed in houses amidships and the crew and firemen in the forecastle. The lighting, ventilating and sanitary arrangements have received special attention, the most improved methods being adopted throughout. Triple expansion engines are being supplied and fitted by Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, having cylinders 25 in., 40 in., and 67 in. by 45 in. stroke, with two large single-ended boilers, 180 lbs. pressure, and in accordance with their latest practice this vessel is to be fitted with a "Contraflo" condenser and the usual auxiliaries.

Clan Mackenzie.—On June 8th, Messrs. Wm. Doxford and Sons, Ltd., launched from their yard at Pallion, Sunderland, a large 'tween deck vessel, with complete shelter deck, built to the order of the Clan Line Steamers, Ltd. (Messrs. Cayzer, Irvine & Co.), Glasgow, for whom Messrs. Doxford have sister vessels in hand. The dimensions are: Length, 445 ft.; breadth, 53½ ft.; moulded depth, 29 ft.; deadweight capacity, 8,500 tons. The engines and boilers are being constructed by Messrs. Doxford. Classification is with British Corporation.

Hopemoor.—On May 31st, in the presence of a large and interesting gathering of ladies and gentlemen, there was launched from the shipyard of Messrs. John Readhead and Sons, Ltd., West Docks, South Shields, a steel screw steamer, built to the order of Messrs. Walter Runciman and Co., Newcastle-on-Tyne. The vessel is of the improved single deck type, and is built to Lloyd's highest class, and under their special survey. She is 358 ft. 6 in. in length, by 49 ft. by 26 ft. 8½ in., with poop, long extended bridge, and top gallant forecastle. The vessel is fitted throughout with wood shifting boards and feeders in compliance with the requirements of the Grain Loading Act, and is well equipped with a large number of steam winches and derricks for the rapid handling of cargoes. She has a double bottom for water ballast as well as a large after peak tank. The vessel will be fitted with triple expansion engines also constructed by Messrs. John Readhead & Sons, Ltd., having cylinders 25 in., 42 in., 68 in., by 45 in. stroke, steam being obtained from two large steel boilers of 160 lbs. working pressure. There is also a large marine type donkey boiler.

Vard.—On June 8th, a large steel screw steamer was successfully launched at Southwick. The vessel has been built to the order of Mr. And. Jacobsen, Christiania, and is of the following dimensions: Length, 360 ft., breadth 50 ft. 10 in., and depth moulded 26 ft. She is built to Det Norske Veritas' highest class, with one deck laid, and has bridge, poop and topgallant forecastle. The engines and boilers are to be fitted by the North-Eastern Marine Engineering Co., Ltd., Sunderland, with cylinders 24½, 40½, and 67 in., with a stroke of 45 inches, steam being supplied by two large boilers of 180 lbs. pressure.

LAUNCHES—Scotch.

Cameronia.—On May 27th, there was launched at Partick the 10,500-ton steamship *Cameronia,* which has been built for the Anchor Line's passenger and cargo service between Glasgow and New York. The vessel, which will be ready for service in August, will run in conjunction with the steamers *Columbia, Caledonia,* and *California.* The *Cameronia,* which was named and launched by Lady Hermione Cameron of Lochiel, is a twin-screw steamer 530 ft. in length over all, 62 ft. in moulded breadth, and 36 ft. 6 in. in moulded depth. She is a strikingly handsome vessel, with two steel pole masts and two funnels. She is divided into nine water-tight compartments, and is provided with ample appliances for the safety of the passengers. The first-class accommodation, for 240 persons, is amidships. Most of the state-rooms are on the bridge and promenade decks, and are arranged for one, two, or three passengers in each. There are also a few first-class rooms on the main deck. The first-class dining saloon, the largest apartment in the ship, is on the upper deck. It will seat about 200 persons. The second-cabin passengers, of whom 424 can be carried, will be berthed largely on the same deck as the first-class, but entirely separate. Their rooms are fitted for two or four each, with a few larger cabins for family parties. There are two second-class dining saloons, a ladies' room, and a smoking-room. Of third-class passengers, 900 will be provided for. There will be special accommodation for married people, families, and single women. The vessel will be supplied with triple expansion, four-crank engines, on the balanced system. Steam will be generated in six double-ended, and three single-ended boilers, working at a pressure of 200 lb. per square inch. The deck auxiliary machinery includes steam steering gear, controlled by telemotor, and fitted with liquid control brake to avoid jarring and straining in heavy weather, steam windlass and capstan on the forecastle, and two steam capstans aft. On the boat deck are two electric winches for lowering and hoisting the boats. The *Cameronia* will be able to carry a large cargo, and is provided with specially large hatches. To facilitate the loading and discharging of cargo there are nine powerful horizontal winches. The *Cameronia* is the largest ship which has ever been built to pass regularly up and down the Clyde. The development which she represents as compared with the old *City of Glasgow,* which sailed on her maiden voyage from the Clyde about 60 years ago, is well shown by the following comparisons: *City of Glasgow*—Length, 220 ft.; breadth, 32 ft.; depth, 21 ft.; tonnage, 1,608 tons; engines, overhead beam jet condensing; indicated horse power, 1,500. *Cameronia*—Length, 530 ft.; breadth, 62 ft.; depth, 36 ft. 6 in.; tonnage, 10,500 tons; engines, twin screw triple expansion four crank; indicated horse power, 11,000.

Ul.—On May 29th, a very fine screw steam yacht of about 730 tons Y.M. was launched at Leith for His Imperial and Royal Highness the Archduke Charles Stephen of Austria, by Messrs. Ramage & Ferguson, Ltd., built to designs by Mr. Alfred H. Brown, of London. Her principal dimensions are: Length, 225 ft.; breadth, 29 ft.; depth moulded, 17 ft. 6 in.; with an awning deck fore and aft and two masted schooner topsail yard, schooner rig. The owner's accommodation is situated both before and abaft the engine space with intercommunicating passage between, and consists of large royal reception rooms fitted by Waring & Gillow, London, and very roomy sleeping apartments for the Archduke, his family and friends. The general appointments of the yacht are of the highest class, a special feature is a large entrance hall entered through a door in ship's side, with staircases leading to the cabins and awning deck. Steam steering gear, windlass and capstan combined and two warping capstans aft by Reid, of Paisley, are fitted, and a very complete electric installation is installed with two dynamos, one being driven by steam engine and the other by an oil motor for use in port. The machinery consists of a compact set of triple expansion engines having 16 in., 26 in., 42 in.

diameter, by 27 in. stroke, with two steel boilers working at 190 lbs. pressure, which are expected to drive the yacht at a high rate of speed.

Robert Dollar.—On June 2nd, was launched at Port Glasgow the steamer *Robert Dollar,* built for the Robert Dollar Company, San Francisco. The principal dimensions of the vessel are: Length, 410 ft.; breadth, 54 ft.; depth moulded, 29 ft. 9 in. She has a deadweight carrying capacity of 8,800 tons, and a gross registered tonnage of 5,350. The vessel, which is designed for the timber trade, has four masts, large hatchways, and all modern appliances for the rapid handling of cargo.

Kirkfield.—On June 10th, there was launched at Port Glasgow a steel screw steamer, named *Kirkfield,* for Mr. James R. Cuthbertson, Glasgow. She has been built to 400 ft.; breadth, 51 ft. 10 in.; and depth, 29 ft. 6 in.; whilst her gross tonnage is about 4,750. The steamer will have triple-expansion engines, the cylinders being 26½, 44, and 72 in. in diameter, by 48 in. stroke.

Pungue.—On June 12th, Messrs. Wm. Simons & Co., Ltd., Renfrew, launched from their works one of their latest types of single screw combined bucket suction and discharging dredgers, the *Pungue,* which they have constructed for the port of Beira. As customary with Messrs. Simons & Co., the vessel was launched with all its machinery on board complete ready for work. The hull and machinery have been built to Lloyd's highest class and the bucket and pump dredging outfit embodies all the most modern improvements. The bucket ladder is arranged so that the bucket can dredge the vessel's own flotation. The dredging pump is arranged to deliver through a long length of floating and shore pipes. The propelling power is provided by one set of compound surface condensing engines. Steam is supplied from one steel boiler constructed to Lloyd's requirements for a working pressure of 120 lbs. per square inch. The propelling engine is arranged for driving the bucket chain and the dredging pump. The engine room auxiliary outfit includes independent feed pumps, bilge pumps, service pumps, circulating pumps and condenser. The dredging machinery is of strong design, and all parts of the gearing and bucket chain are of special hard and durable steel, so as to reduce wear and tear to a minimum. Independent steam hoist gears are provided both for ladder and suction pipe. The mooring winches are provided at bow and stern. The *Pungue* has been built under the direction of Messrs. Livesey, Son & Henderson, London, consulting engineers to the owners, assisted by Messrs. Thomas Nash and Son, Inspecting Engineers, Sheffield.

Remuera.—Messrs. Wm. Denny & Bros., Dumbarton, recently launched the twin screw steamer *Remuera,* built to the order of the New Zealand Shipping Co., London. The vessel is 484 ft. in length, 62 ft. moulded breadth, and 35 ft. depth to upper deck. The vessel is finely equipped for both passenger and cargo carrying, the whole of the forward part of hull being insulated for the conveyance of frozen meat cargo. She will be propelled by two sets of direct-acting triple expansion engines, which with the necessary boilers have been built by Messrs. Denny & Co., of Dumbarton Engine Works. The *Remuera* is the eleventh vessel to be built for the New Zealand Shipping Co. by Messrs. Wm. Denny & Bros., and is just double the size of the first vessel supplied to the company.

LAUNCHES—Irish.

Vandyck.—On June 1st, the twin screw steamer *Vandyck* was launched by Messrs. Workman, Clark & Co., Ltd., Shipbuilders, Belfast, for Messrs. Lamport & Holt, Liverpool. The steamer is intended for the owners' passenger and cargo service to the Brazils and River Plate.

TRIAL TRIPS.

Langholm.—On May 23rd, the handsome steel screw steamer *Langholm,* built by Messrs. Wm. Gray & Co., Ltd., to the order of the London and Northern Steamship Co., Ltd. (Messrs. Pyman Bros., London, managers), had her trial trip. After a preliminary run along the coast, the vessel was put upon the measured mile at Whitley, when a speed of 12 knots was attained. See Launches, May.

Cliftonian.—On May 23rd, the steel screw steamer *Cliftonian* built by Messrs. The Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne, to the order of Messrs. J. Mathias & Sons, Aberystwyth and Cardiff, left the Tyne for her Official Trial Trip. The vessel is 390 ft. long by 49 ft. beam by 29 ft. deep, and has been built under special survey to the highest class at Lloyd's. She is fitted with long bridge, long poop, topgallant forecastle, the accommodation which is very ample being placed in steel houses on the bridge deck. The 'tween decks are lofty and so arranged that cattle, troops, or emigrants may be carried if necessary. Very special attention has been paid to the loading and discharging gear, and a complete outfit for the rapid handling of cargoes arranged for, consisting of eight steam winches by Messrs. Clarke, Chapman & Co., Ltd., Gateshead-on-Tyne, a large number of cargo derricks, and steam windlass by Messrs. Emerson, Walker & Thompson Bros., Dunston-on-Tyne. She is fitted with the usual water ballast arrangements for light passages. The machinery has been supplied by Messrs. The North Eastern Marine Engineering Co., Ltd., Wallsend, consisting of engines with cylinders 25, 41, 69 by 48 in. stroke, three large steel boilers with 180 lbs. pressure. This vessel carries about 7,500 tons on a light draught and will steam about 10 knots loaded at sea. The trial trip proved in every way satisfactory, and a speed of 12 knots was obtained. After the trial trip the vessel proceeded to Tyne Dock to load for the Suez under the command of Capt. A. O. Jones.

Boheme.—On May 24th, the single deck steamer *Boheme,* built and engined by Messrs. Wm. Doxford & Sons, Ltd., Sunderland, to the order of Messrs. Marco. U. Martinolich & Co., Lussinpiccolo, ran a successful trial, when a mean speed of 10¼ knots was attained. See Launches, June.

Lola.—On May 25th, the trial trip took place of this powerful steel screw tug and service vessel which has been designed and constructed by James Pollock Sons and Co., Ltd., of 3, Lloyds Avenue, London, and Liverpool. The dimensions of the *Lola* are: Length, 64 ft.; breadth, 14 ft.; depth mean, 5 ft. 3 in. This vessel, which is intended for the West Coast of South America, obtained the satisfactory speed of 10¾ miles. The *Lola* is fitted with compound surface condensing engines, having cylinders 10 in. by 22 in. diameter by 15 in. stroke, and a return tube boiler with a working pressure of 130 lbs. The water tanks and special keels will specially suit the vessel for heavy sea work. This vessel will be shipped by Messrs. The Nautilus S.S. Co.'s new steamer now nearing completion, and will be launched from the deck of same at her destination.

Kronstad.—On May 25th, the trial trip took place off the Tyne of the new steamer *Kronstad,* which has been built by Messrs. William Dodson & Co., of Walker, for Messrs. Grefstad & Herlofson, of Arendal, Norway. This vessel has been built to the highest class at Norske Veritas and is of the following dimensions: Length between perpendiculars, 313 ft.; breadth, 46 ft. 6 in.; depth moulded 23 ft. Triple expansion engines have been fitted by the North Eastern Marine Engineering Co., Ltd., of Wallsend, having cylinders 23, 38, 62 by 42 stroke, with two single-ended boilers. After a satisfactory trial on the measured mile the vessel left for Methil to load a cargo for Cronstadt.

Andalusian.—On May 27th, the s.s. *Andalusian,* built by Messrs. W. Harkess & Son, Limited, for Messrs. The Ellerman Lines, Ltd., was taken for her official trial trip. A very complete programme of tests and trials of deck machinery, gear and auxiliaries was gone through to the entire satisfaction of the owners, and a mean speed of 12 knots was obtained as the result of a series of runs on the measured mile. See Launches, June.

Bolinders.—On May 29th, this new motor fishing vessel, which has been built jointly by James Weatherhead of Eyemouth, and James Pollock Sons & Co., Ltd., of London and Liverpool, the latter supplying the motor, was put through her trials at Eyemouth, when the excellent speed of 11½ miles per hour was obtained, the same being a mean of four runs on the Admiralty course. The maximum speed on a single run was 13 miles. In testing the manœuvring powers of this vessel, it was found the vessel when going full ahead could be brought to a

standstill with the engine going full astern in the remarkable time of 20 seconds. We understand that the *Bolinder* has already started on her fishing duties, and the results will be watched with interest. See Launches, June.

Telemachos.—On May 29th, the handsome steel screw steamer, *Telemachos,* built by Messrs. Wm. Gray & Co., Ltd., West Hartlepool, for Mr. George C. Dracoulis, of Braila, had her trial run to the Tyne, where she takes in her first cargo. After adjustment of compasses, the vessel was headed for the Tyne, where she arrived after a splendid run, her average speed as registered by the log being 12¼ knots, and the performance of both ship and machinery giving great satisfaction to all concerned. See Launches, June.

Lord Lonsdale.—On May 31st, the steamer *Lord Lonsdale,* which has been built to the order of Messrs. John Herron & Co., of Liverpool, by Messrs. William Hamilton & Co., Port Glasgow, was taken on her loaded trial trip, when she maintained a speed of over 11½ knots on the measured mile. See Launches, June.

Kinross.—On June 1st, the steel screw steamer *Kinross,* built by Messrs. The Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne, to the order of Messrs. B. J. Sutherland & Co., Ltd., Newcastle-on-Tyne, left the Tyne for her official trial trip. The trial trip proved in every way satisfactory, and a speed of 11½ knots was easily obtained. See Launches, May.

Tregurno.—On June 1st, the new screw steamer *Tregurno,* built by Messrs. John Readhead & Sons, Ltd., West Docks, South Shields, to the order of Messrs. Edward Hain & Son, St. Ives, Cornwall, was taken to sea on her official trial trip. After the trial, which was in every way satisfactory to all concerned, the vessel proceeded to Tyne Dock to load for Venice, under the command of Captain Blake. See Launches, June.

Kanna.—On June 1st, the new steamship *Kanna* completed by Messrs. Ramage & Ferguson, Ltd., Leith, for the Union Steamship Company of New Zealand, Ltd., ran her official trial trip on the Firth of Forth on the measured mile. A speed of 12 knots was obtained which was considered highly satsfactory. The vessel sailed same day for London to complete her cargo for Durban and New Zealand. See Launches, May.

Holly Branch.—On June 2nd, the *Holly Branch,* built on the Wear for the Nautilus Steam Shipping Co., Ltd. (Messrs. F. & W. Ritson, managers), was taken out to sea for her official trial trip. The vessel, which has been built to take the highest class of the British Corporation Registry, is of the shelter-deck type, with short forecastle forward, clipper stem and bowsprit, and fitted with three masts. She has been specially designed for the owners' trade with the West Coast of South America, and is fitted with 28 derricks and 11 steam winches for the rapid loading and discharging of cargo. Over the measured mile the vessel attained a speed of 14.5 knots. The vessel afterwards left for the Tyne under the command of Capt. Lee.

Exford.—On June 7th, the steel screw steamer *Exford,* built by Messrs. Craig, Taylor & Co., Ltd., Stockton-on-Tees, for Messrs. W. J. Tatem & Co., of Cardiff, was taken to sea for her trial trip, which proved highly satisfactory. During the whole of the trip everything worked with the greatest smoothness, and over a series of runs a speed of 11 knots was obtained, the vessel at the time being fully loaded. Immediately after the trial the vessel proceeded on her voyage to Port Said, under command of Captain W. Hughes. See Launches, May.

Riviera.—On June 7th, the turbine steamer *Riviera,* built at Dumbarton, for the South-Eastern and Chatham Railway Company's Channel service, completed her official trials, which were thoroughly satisfactory. On the run of four hours the speed was 21.99 knots, with only four of the boilers in operation and with very moderate air pressure. The highest mean speed on the mile, with the turbines fully opened out, was 23.07 knots. Several astern runs were also made, and an astern speed of 15.15 knots was attained. There were also exhaustive and successful stopping, turning, and manœuvring trials. See Launches, May.

9,000 Ton Steamer.—On June 7th, a fine shelter deck vessel, built by the Northumberland Shipbuilding Co., Ltd., Howdon-on-Tyne, left the Tyne for her official trial trip. The steamer is jointly owned by Messrs. Houlder, Middleton & Co., Ltd., and Andrew Weir & Co., of London, and is intended for the trade between New York and the Far East, in which the two firms are mutually interested. The trial trip proved in every way satisfactory, and a speed of 13 knots was obtained. See Launches, April.

Blackheath.—On June 8th, the s.s. *Blackheath,* built by Messrs. Ropner & Sons, Ltd., of Stockton-on-Tees, made her official trial trip in the Tees Bay. After some very satisfactory trial runs, during which the vessel attained a speed of over 11½ knots, she proceeded to Barry to load. See Launches, June.

Kinkasan Maru.—On June 10th, this vessel of 8,200 tons D.W., built by Sir Raylton Dixon & Co., Ltd., of Middlesbrough, was taken out on trial trip, and proved in every way saisfactory. See Launches, June.

Clan Macphee.—On June 13th, the s.s. *Clan Macphee* proceeded on her official trial trip, and after adjusting compasses in Hartlepool Bay the vessel proceeded to the measured mile for a test of speed. Everything worked very smoothly, and on four runs on the Whitley Bay measured mile, a speed of 13½ knots was obtained, a very heavy sea running at the time. See Launches, June.

Atlantica.—The large steamer *Atlantica,* built on the Tyne, for the Atlantica Sea Navigation Company of Budapest, recently completed her trial trip. The machinery worked without a hitch of any description, and a speed of 11¼ knots was attained. The vessel sailed afterwards under the command of Captain B. Martha for Immingham, to load her cargo. See Launches, June.

San Andres.—On June 15th, the new steel screw steamer *San Andres,* built by Messrs. Wood, Skinner & Co., Ltd., Bill Quay on Tyne, to the order of Mr. Otto Thoresen, of Christiania, for the Otto Thoresen Line, left the Tyne for her official trial trip. During the trial trip the machinery ran exceedingly well, easily maintaining a mean speed of 13¼ knots, which was considered very satisfactory by all present. See Launches, June.

Saint Leonards.—On June 15th, the new steamer *Saint Leonards,* built by Messrs. Arch. McMillan & Son, Ltd., for Messrs. Rankin, Gilmour & Co., Ltd., Liverpool, ran trials on the measured mile at Skelmorlie, when a mean speed of 13 knots was obtained in light condition. The machinery was supplied by Messrs. Rankin & Blackmore, Greenock, and everything worked most satisfactorily. See Launches, June.

Saldanha.—On June 15th, the steamer *Saldanha* was successfully launched from the Wallsend yard of Messrs. Swan, Hunter, and Wigham Richardson, Ltd. This vessel is being built for the well-known Bucknall Line, under the control of Sir John Ellerman, Bart., and is designed for the general cargo-carrying trade between the United Kingdom, South Africa, and the Far East. The leading dimensions of the vessel are: Length over all, 397 ft., and breadth, 48 ft. 9 in. She has a deadweight carrying capacity of 8,720 tons. The triple expansion engines and the boilers are being constructed by the Wallsend Slipway and Engineering Company.

ANSWERS TO CORRESPONDENTS.

R. M. M., Manilla.—The first compound engine was constructed and patented by Jonathan Hornblower in 1781, but the patent was upset by Messrs. Boulton & Watt for infringement in the use of a separate condenser and air pump. It was revived in 1804 by Arthur Woolf, but it was half a century later before the type was made a commercial success. It is reported that the first engine was built for a brewery in London. In 1814 it was extensively introduced by Woolf as a pumping engine in the mines of Cornwall, but it fell into disuse owing to the competition of the high-pressure single cylinder engine of Trevithick's. The final revival was in 1845, and occurred through several causes. M'Naught introduced a plan of improving beam engines of the original Watt type by adding a high-pressure cylinder whose piston acted on the beam between the centre and the flywheel end. Steam of higher pressure than had formerly been used, after doing work in the new cylinder, passed into the old or

lower pressure cylinder, where it was further expanded. The compound form was selected by Mr. William Pole for the pumping engines of Lambeth and other water-works about 1850.

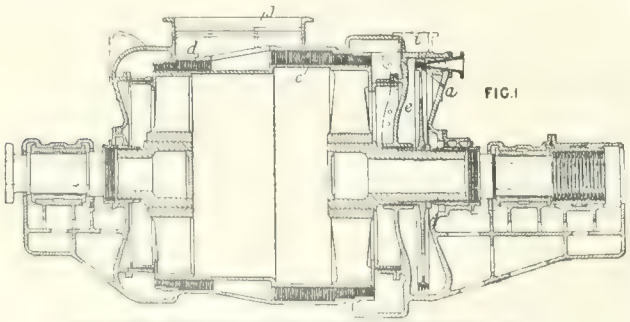
One of the first, if not the first, set of compound marine engines for a screw propeller was built by Messrs. Randolph Elder & Co., subsequently Messrs. John Elder & Co., of Glasgow, and was fitted in the s.s. *Brandon* in 1854. From further information supplied by the Fairfield Shipbuilding and Engineering Co., successors to Messrs. Elder & Co., the engine fitted in the *Brandon* was vertical, direct-acting and geared. She made her trial trip in July, 1854, and was subsequently engaged as a despatch-boat during the Crimean war. The Fairfield Co. further state that the late John Elder as early as 1862 patented arrangements for working steam expansively in four successive cylinders (the present quadruple-expansion engine), and also an improved kind of water-tube boiler, evidently with a view of obtaining steam of higher pressure than the boilers then in vogue were capable of carrying.

A. A., Manchester.—Excluding warships and the sort of mayfly yacht which races at Cowes and the Riviera, in the serious business of shipping for commercial purposes, there are no vessels to touch the speed of the two Cunarders *Mauretania* and *Lusitania*, whose speed under favourable circumstances may be put at 26 knots, a speed which they are capable of maintaining for a full twenty-four hours, if not for the whole Atlantic passage. The new vessels *Engadine* and *Riviera*, built for the Cross-Channel fleet of the South-Eastern & Chatham Railway, are to be of 23 knots speed, and that rate of progress has been maintained by the *Newhaven*, recently added to the Newhaven and Dieppe service by the French State Railways. The new Ostend liners are also of this speed, as are the City of Dublin vessels employed in the carriage of mails between England and Ireland, whilst the Great Western Co.'s Fishguard liners have a similar speed. One or two of the Isle of Man Co.'s vessels also average 23 knots. The express steamers of the Nord Deutscher Lloyd Co., engaged in the New York service, do their 23 knots at sea.

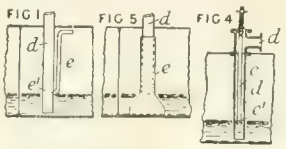
The Marine Engineer and Naval Architect Patent Record.

Compiled by Messrs E P Alexander & Son, Chartered Patent Agents, 306, High Holborn, London, W.C.

3,560. Turbines. In a marine turbine installation, an impulse element *a* is mounted within the same casing as a low-pressure reaction element *c*, but the steam, after passing through the impulse element, is exhausted through a pipe *i* to one or more intermediate-pressure reaction elements (not shown) mounted upon another shaft or shafts, and is afterwards exhausted back into the element *c*. The object is to enable part of the turbine casing containing the impulse staging to be made of about the same diameter as the remainder. Regulating-valves controlling the admission of steam to the impulse stage are provided. Additional impulse stages may be provided and valves arranged so as to by-pass certain of these stages. In duplicated installations, comprising port and starboard sets, conduits with suitable valves are arranged so that port and starboard impulse turbines may be worked alternatively in series or in parallel, the reaction turbines always working in parallel. An astern turbine *d*, exhausting into the same passage *j* as the low-pressure stage, may be added.

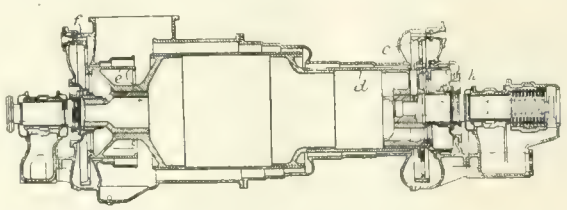


3,658. Ships. *Leakage, detecting, stopping, and removing.*—In order to save the waste oil that accumulates in the bilge below the engine room, the bilge suction-pipe *d*, Fig. 1, is fitted with a pipe *e* open to the atmosphere. The suction is thus broken at a pre-determined level *e1*. The pipe *e* may



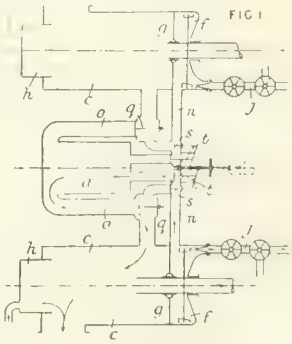
be adjustable in the interior of the pipe *d*, as shown in Fig. 4, and it may be graduated. Fig. 5 shows a form in which the pipe *d* passes down a wider pipe *e*, at the top of which air enters. In a further form, a ball float operates an air cock.

4,100. Turbines. A combined ahead and astern turbine, comprising an impulse stage *c* and a reaction part *d* for forward driving, and similar elements *e*, *f* for reverse driving, is provided with a single dummy piston *k*. The exterior surfaces of the dummy piston are subjected to the pressure



in the impulse stage *c*, and the interior surfaces are subjected to the pressure in the impulse stage *f*, whereby the end thrust is balanced for either direction of rotation. The position of the dummy piston may be varied, and the low-pressure side may be placed in direct communication with the exhaust.

4,291. Turbines. A three-shaft marine turbine plant consists of two side turbines, as described in Specification 3,560/10, and a central turbine. A high-pressure reaction turbine *a* is mounted upon a central shaft, and low-pressure reaction turbines *c* are mounted upon the side shafts, the low-pressure turbines having one or more impulse stages *f* incorporated therewith, but separated therefrom by a partition *g*. Each side shaft is also provided with an astern turbine *h*. For normal running, steam is first admitted to the stages *f*



through pipes *j*, whence it flows through pipes *n* to the turbine *a*, and afterwards passes by way of pipes *o* to the low-pressure turbines *c*. Check valves *q* are arranged in the pipes *o*, and interdependent valves *s*, *t* are provided, so that the steam leaving a stage *f* may be directly by-passed to its corresponding turbine *c* without passing into the turbine *a*. The upper part of the Figure shows the turbine *a* cut out, and the lower part the method of normal running. In a modification, the valves *q* are of the type described in Specification 22,748/04, and the arrangement of the other valves is also modified.

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